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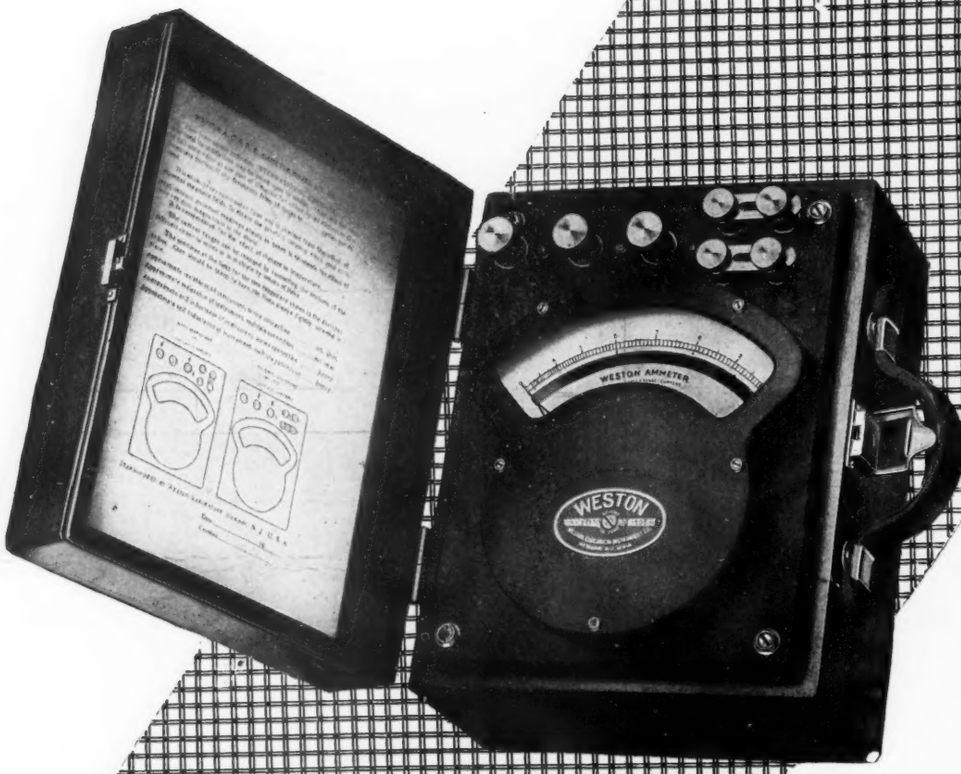

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, August 10, 1918 *Number* 6

Engineering Education Must Go On

PROBABLY there never was a time when it was so hard for undergraduate students in engineering to stick to their school work as it is to-day. Yet there could be few calamities for this nation greater than for our technical institutions to close for lack of students, and this in face of the tremendous demands of the hour for men for military and naval service. Whether the war goes on for years or whether it ends within six months, the need of technically trained men in the nation's life at home and abroad will be so great that the supply cannot possibly meet the demand. Fortunately, there is no immediate danger that our schools of applied science will have to shut up shop; but there is ground for apprehension that the registrations of the coming fall will be lower than need be unless the patriotic import of hard technical study becomes more generally appreciated.

A recent announcement of the War Department is significant in this connection. Students of the Massachusetts Institute of Technology, and presumably of other institutions of similar character, are to be on virtually the same footing as enlisted men in the United States service when they return for instruction next fall. This plan means that failure to meet the scholastic requirements will result in men otherwise in a deferred classification of the draft being taken from school and inducted into active service. It is directly in accord with that advocated by prominent alumni of the Institute who have felt strongly that the technical schools are of such vital need to the nation in the present emergency that their opportunities should not be trifled with. The plan consolidates more closely than ever the relations existing between technical schools and the country's needs.

When there is time to prepare it, the educational history of the great war as developed on this side of the ocean will show that the contributions of American professional and trade schools in intensive and varied training for service both at the front and behind the lines, from the listening post in No Man's Land to the factory bench and humble boiler room at home, have been of a value which it would be difficult to overestimate. It is none too early to begin to prepare for the immense tasks of reconstruction and expansion of world interests in business and trade which this country will have to accomplish when hostilities are at an end, and in a large sense, indeed, all personal study in the field of applied science and in related economic branches must go forward with its high responsibilities and opportunities in mind. To some will come the call for immediate service; to others the opportunity to be of maximum use will be postponed until the benefits of longer and deeper preparation can be rendered to the nation. Let no one fail because instant opportunities for great adventure must be held in abeyance, but let us all strive to equip ourselves better to serve our nation and our time by continuing and perfecting our studies, whether from the seasoned standpoint of maturity or from the point of view of the youngest matriculator in the class of 1922.

Reconstruction After the War

THE war caught this country unawares and there is a certain sense of pride in this unpreparedness as indicating our peaceful intentions. But there will be no such pride or satisfaction should peace also find us unprepared, and lead to a painful and wasteful reconstruction. The resources of the country, in so far as thinkers and scientists are concerned, have by no means been fully mobilized. We cannot say that we are too busy at the present time to consider peace problems. Thousands of capable and competent persons would welcome a call for organization to work on various problems of reconstruction, political, economic, scientific, technical, cultural and legal.

It is an open secret that Great Britain was on the verge of a great political and economic change before the war began. The stress of the military situation has helped to stave off the troublesome domestic problems, but the far-sighted British government has realized early in the war the necessity for a thorough-going reconstruction which must be carried on simultaneously with the war and not considered only after the conclusion of peace. The Ministry of Reconstruction has been made a separate and quite active branch of the British government, and the reports that appear from time to time in the technical press bear ample witness to the fruitful and thorough-going activity of this new child of the great war. This ministry has some ninety committees working on various general and specific problems that have arisen or will arise after the war. These activities comprise all the important branches of industry and science. Extracts from some of the reports that bear directly or indirectly upon the electrical science and industry have been mentioned on one or two occasions in our research section.

Up to the present time no such organized branch of government has been formed in this country to deal broadly with problems of reconstruction when this world war is finally ended. It may be more in ac-

cordance with the spirit and the traditions of the United States to have this problem first tackled by various scientific and industrial bodies, each working upon its own problems of reconstruction, and only later have the government or some specially organized national body take a hand in it for the purpose of unifying the activities and the results of the special committees.

The electrical industry will have a large number of reconstruction problems to consider, and some of these problems are sufficiently clear and pressing at the present time to bear investigation without further delay. As such may be mentioned the unification of power supply, finding places for employees now in the military service, readjustment of rates, etc.

There is no single body that could undertake a solution of all such problems for the whole electrical industry, but it may be well for the separate bodies, such as the National Electric Light Association, American Institute of Electrical Engineers, the Engineering Council, the Power Club, the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers Association and others to appoint committees for a preliminary report on the forthcoming reconstruction problems. These are partly international in so far, for example, as competition in foreign markets is concerned, and partly national and even local to be considered by each small lighting company or retail dealer in electrical supplies, but they all need attention.

Motors for Wood-Working Machinery

PROFESSOR CLEWELL'S article on this topic gives a very comprehensive view of the requirements to be met in fitting a wood-working plant with electric drive. That such motor equipment is desirable under present-day conditions is very well understood, in almost any case of manufacture, but in wood-working machinery there are certain particular advantages in facilitating the orderly progress of work through the shop. One of the familiar characteristic advantages of motor-driven machines over any system of shafting and belting is that the position of a given machine is in no wise dependent on the fixed position of a drive, so that every item of the equipment can be placed where its relation to the others is thoroughly convenient. Thus the transfer of work from one operation to another is greatly facilitated and both space and labor economized.

For driving wood-working machinery the induction motor possesses such characteristic advantages that practically nothing else would be considered on its merits even were there a choice of direct-current and alternating-current service. The immunity of induction motors from the ill effects of dust and dirt, and freedom from danger of fire through the misbehavior of a dirty commutator, form sufficient reasons for abandoning any machine that has a commutator. Only in very rare instances, where extreme variation of speed is required for special operation, has the direct-current motor any claim to consideration. Most wood-working machines are conveniently driven by motors of the squirrel-cage type. If the squirrel-cage rotor has low slip it drives ahead with remarkably good speed regulation and so holds up the output. If only a small amount of flywheel effect is desired the same type of motor designed for larger slip meets the requirement, but wherever great flywheel effect is necessary it is generally thought desirable to install a slip-ring motor with an external resistance, preferably adjustable, to meet the requirements of flywheel working, although a fixed resistance is frequently all that is necessary. The latter arrangement is a common practice in operating the large bandsaws for timber sawing. These saws may run at speeds up to 10,000 ft. (3048 m.) per minute and the band wheels themselves may weigh several tons. In such instances the flywheel effects are very powerful, and there must be heavy starting effort and reliance on stored energy to drive through peaks of load.

With certain other classes of wood-working machinery, such as planing mills, cases also occur where the slip-ring type of motor with wound rotor is advisable on account of the necessary heavy starting torque. Push-button control, often from more than one point, is found to be a very important feature in the operation of certain machines, saving much time and electrical energy as well.

The Transmission of Light Through Water

THE law of the transmission of light through various thickness of approximately transparent media is well known, the total transmission through any thickness, say n units, being the nth power of the transmission through unit thickness. There is every reason to expect that this relation holds for any medium in which the stoppage of light is, so to speak, homogeneous, and in which there is no marked selective action to change the effective luminosity. There have been but few attempts to verify the law experimentally, and the recent experiments reported by Mr. Rose in the current number of the *General Electric Review* are therefore of particular interest. The substance used was water, especially convenient on account of the ease with which it may be obtained homogeneous and in great thickness. The major cause of the lack of transparency in water is the presence of suspended matter, which may, however, be assumed to be quite uniformly distributed. The test was made by actually measuring the absorption of light from a metallic filament lamp slid along a tank filled with water and properly screened, at the end of which just below the surface rested the photometer test plate. The water was ordinary city water obtained from artesian wells. The result as regards the effect of relative thickness was precisely what was to be anticipated, the exponential law being verified well within the limits of experimental error.

The particularly interesting feature of the results from a practical standpoint is the very considerable cut-off of light produced by a substance apparently so transparent, amounting for a single foot (0.05 m.) of water to 27.5 per cent. On this basis the transmission through 50 ft. (15.2 m.) of water would be only about one part in 10,000,000 of the incident light. These figures are sufficient to show the difficulty of carrying out any experimental or practical work with light where considerable thicknesses of water are involved. Sea water is probably on the average somewhat less trans-

parent than even these figures would indicate, particularly where the apparent hue of the water is greenish or turquois blue, which tints bespeak a fairly considerable amount of suspended matter and consequently increased opacity.

On the other hand, water, either of lake or sea, sometimes is extraordinarily free from suspended matter, except in very fine particles, so small in comparison with the wave length of light as to exercise a strong selective action on the blue, which in itself would show a high absorption coefficient, while the general absorption for white light would be conspicuously lower than in the case tested. It is well known, for instance, that in very clear water, particularly in the tropics, small objects can be seen on the bottom by means of a water telescope at depths of 40 or 50 ft. (12.2 to 15.2 m.). It is apparent, however, that the transmission coefficient of water under ordinary circumstances is rather surprisingly low, and only reaches high values in cases where nature or art has freed the liquid from most of its suspended matter, or at least left it comparatively free of particles large enough to affect considerably the brighter part of the spectrum.

A Genuine High-Voltage Plant

NOW is the time when, in order to attract any perceptible amount of attention, a new power transmission plant must be characterized by some features still unusual. This merit certainly belongs to the new Michigan plant of the Consumers Power Company described in our current issue. It is the latest feeding plant on that great network which covers the central part of the State of Michigan, and which came to special notice some years ago as being almost the very first system on which the working voltage passed 100,000. The present installation is not only the largest in Michigan, but operates regularly at 140,000 volts with a main transmission slightly more than 100 miles (160.9 km.) long. This voltage has been used before on the system, but not on so extensive a scale.

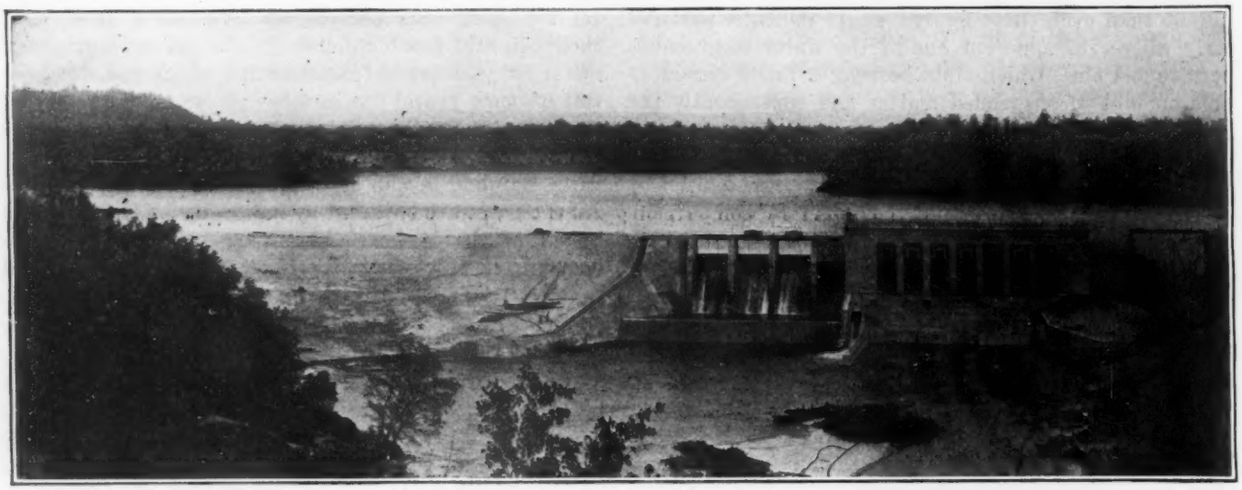
The hydraulic plant possesses some features of interest in that it involves a concrete dam on a foundation of clay hard-pan, although the working head is about 50 ft. (15.2 m). There are several similar dams on the system, but this is quite the largest and most important. The location is on the Manistee River, which is extremely free from heavy floods, so that the construction chosen was well justified by the hydraulic conditions. During development of the plant the river was diverted and power for building the new hydraulic works was derived from a power plant a few miles up the stream built particularly for this purpose and of 800-kw. capacity. The power house, nearly 150 ft. (45.7 m.) long, stands in the old river channel. The three concrete penstocks present an interesting feature in their slightly flexible joints reinforced by corrugated metal strips, a type of construction which has stood the test of some years' use in other plants. On account of the severity of the winter climate provision is made for heating, by steam radiators, one of the spillway gates so that it can be quickly opened if necessary. All the gates are operated by motor-driven worm-geared hoists, which are operated from the power-house switchboard. The whole capacity of the plant is concentrated in three vertical direct-connected units with single-runner wheels coupled to generators of 5500-kw. capacity at 75 r.p.m.

It is worth noting that the full efficiency of the turbines under test slightly exceeds 90 per cent, with an efficiency above 80 per cent all the way up from 0.4 load. The frequency adopted for this plant is 30 cycles, which was already employed in part of the system in northern Michigan, although the general frequency is 60, to which the power delivered from this station is to be for the most part changed at the receiving end of the line. The power-house equipment is of the simplest possible character, the whole high-tension equipment being placed in an out-door substation. Being part of a large network with a long transmission line to serve as buffer the station needs, and has, no elaborate protective system at all. The working low-tension switchboard is installed at the end of the station, where the control for the high-tension switches outside is also situated. The cables for the step-up transformers pass through a concrete subway from the basement of the power house to an out-door substation with three 5000-kva. single-phase transformers, delta connected for 7500 to 140,000 transformation. They are of the water-cooled type and are provided with taps to give from 120,000 to 140,000 volts as required. Provision is made for readily shifting the transformers to open-delta connection in case of accident, no spare transformer being deemed necessary considering the connection of this station to the rest of the system. The high-tension oil switches are non-automatic solenoid operated, and are worked from the station, in charge of an operator responding to the calls of the load dispatcher, who manages the whole network. The high-tension buses consist of galvanized-iron pipes supported on strain insulators.

The whole plant has been built with simplicity, efficiency and economy constantly in mind, with full realization of the fact that it is not the sole reliance of a great network, but one of many plants, and used especially in taking up peak load. In all such cases the whole aggregate of plants must be taken into account in making provision for adequate reserves, so that each unit may be, and for sound economy should be, comparatively simple.

The Coming Issues

FURTHER details regarding the operating problems involved in the proposed interconnection of New England public utilities will be given in an early issue of the ELECTRICAL WORLD, together with an outline of the methods used in solving them. Industrial subjects will also be discussed, such as the application of motors and control apparatus to printing machinery and features and performance of an electric furnace installation in New Jersey. Opinions on how to conserve fuel will also be presented.



New Plant Added to Michigan System

Junction Development, the Largest Hydroelectric Plant in Michigan, Has Several Hydraulic Features and Is Model of Simplicity—Connected with Grand Rapids by 140,000-Volt Line

THE Consumers' Power Company, which operates a large interconnected electric service system in the lower peninsula of Michigan, has recently completed the largest hydroelectric plant in that state. It is situated on the Manistee River about 3.5 miles (5.6 km.) from Wellston and is called Junction Development, since a river known as the South Branch joins the Manistee near the site. The plant, which is rated at 16,500 kw., is being operated in parallel with the rest of the company's system as a peak plant, a 140,000-volt transmission line connecting it with Grand Rapids, 101 miles (162.5 km.) away, while other lower-voltage lines join it with nearer places. In general the plant will utilize all of the flow of the river, although the capacity of the pond, which covers 1560 acres (631.3 hectares), permits considerable flexibility. The plant will be used to meet the requirements of the 30-cycle system (the part south and east of Grand Rapids operating at 60 cycles) so that no definite daily program of operation may be expected. However, it will usually be possible to avoid wasting any water over the spillway.

Among the hydraulic features of the plant are the following: The head is 51 ft. (15.5 m.), which is an unusual height for a dam resting on an earth foundation. The flow of the Manistee River is remarkably uniform, the extreme flood being only about four times the ordinary low-water flow. The 452,500 cu.yd. (345,963 cu.m.) of sand fill in the embankment which comprises part of the dam was deposited by a sluicing process during the winter of 1917-18 with very satisfactory results as to water tightness and settlement, the seepage being only 0.46 cu.ft. (13 cu.dec.) per second and practically constant for two months. Special hydraulic joints are used in the various structures, and provision is made to prevent the gates freezing fast in any position. The dam construction employed to prevent erosion of the river bed by the water tumbling over the dam and for other reasons is also interesting.

Electrically the plant is about as simple as could be imagined, this being a feature which dates back to the beginning of the system. It will probably be remembered that this system was one of the first (under a different name at that time) to attempt real high-voltage transmission (110,000 volts) and that oil switches, lightning arresters and insulators suitable for 110,000 volts were hardly known at the time. The interior of the station contains little more than the generators and the low-voltage oil switches, the cables running to outdoor equipment, including 140,000-volt transformers, aluminum-cell lightning arresters and oil switches controlled from within the station. Having relatively small rating compared with some hydroelectric plants in the West and being tied in with the rest of the system by long transmission lines that act as dampers to any surges that may occur, the station has no elaborate protective equipment in the form of relays, reactors, etc.

Two conditions made it particularly desirable to locate a station at the site chosen. One was that the Manistee River valley in general is broad, while here was a narrow part across which a dam could be easily erected. Secondly, this site is the farthest downstream where a clay bottom exists and at which a dam of reasonable height would back up the water to the next good site above.

Within the last fourteen years the owners and designing engineers of this development have built several other successful dams upon similar clay hard-pan foundations with heads ranging from 26 ft. to 40 ft. (7.9 m. to 12.2 m.), seven being on the Au Sable, Muskegon and Grand Rivers in Michigan. Where the hard-pan is compact and continuous no round or sheet piling has been used. At Junction Dam a line of sheet piling extends across the valley and to a depth of about 40 ft. (12.2 m.) below normal river surface.

The watershed above Junction Dam is 1451 sq. miles (376,000 hectares), and at its maximum elevation Junction Pond has an area of 1560 acres (63.1 hectares). The dam backs up the water in the main river about 8 miles (12.9 km.), and in the South Branch, which enters

1.5 miles (2.4 km.) above the dam, a total distance of about 4.5 miles (7.2 km.) to the Stronach Development built in 1912 by the same owners. Stronach Development was built primarily to furnish power for the construction of the larger dam and contains two 400-kw., 7500-volt, 30-cycle generators, which feed into a transmission line operating at 40,000 volts and extending from Manistee to Cadillac, a distance of 50 miles (80.5 km.). A 7500-volt line extends to Junction Development.

The Junction power house and spillway were placed immediately in the old river channel, the river having been diverted during construction. The power house is 145.5 ft. (44.3 m.) in length and 40 ft. (12.2 m.) in width. Beyond this is the spillway, consisting of four motor-operated 24-ft. by 13-ft. (7.3-m. by 4-m.) steel Tainter gates surmounting a hollow concrete structure.

The ordinary flood is about 5000 cu.ft. (141.5 cu.m.) per second, and the maximum flood on record for the past twenty years is 7500 cu.ft. (212 cu.m.) per second. Two of the gates will, therefore, safely discharge the maximum flood on record without causing rise of headwater. The freeboard on the embankment is 12 ft. (3.7 m.), to provide for the possible failure of any future dam upstream.

Water passing through the Tainter gates is received in a tumble bay 24 ft. (7.4 m.) deep, formed by a solid concrete weir of this height across the spilling channel, the crest of this weir being 13 ft. (4 m.) above tailwater. The spillway operates successfully to deliver the water at low velocity. In passing 5000 cu.ft. per second through the spillway sand lies undisturbed on the last 50 ft. (15.2 m.) of concrete apron.

POWER HOUSE AND PENSTOCK JOINTS MADE WITH GREAT CARE

Special attention had to be given to the design and construction of joints in the power-house structure to prevent leakage from water, since a total head of 42 ft. (12.8 m.) exists at the wheel pit. Below this level the greater thickness of concrete and absence of necessary joints made the problem simpler, although a higher head exists. The construction joints in the penstocks have been made as few as possible and where necessary have been made water-tight by specially bent copper or corrugated galvanized ingot-iron strips, these strips crossing the joints and permitting by their special corrugations movements at the joint. With sufficient care to prevent injury to the strips during construction this type of joint has proved quite satisfactory after using for a number of years in heads up to 60 ft. (18.3 m.). This type of joint is also used at intervals in the embankment core walls, the water-tightness of which is in a great measure due to the care taken with the joints. Construction plans were prepared in detail, indicating exactly where joints were allowed, and no departure from this joint program was permitted without thorough consideration by the designing engineers. The maximum length cast without joints was 114 ft. (34.7 m.) for the downstream wall of the three penstocks.

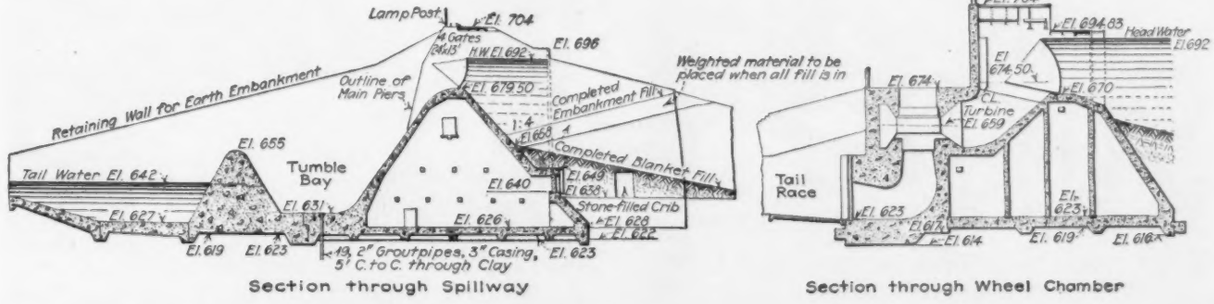
There is a curtain wall of smooth, hard, dark-colored brick along the upstream wall of the power house, the object being to exclude any dampness and hide any unsightly small leakage which might come through the concrete on this side of the room. However, practically no leakage or dampness has resulted.

STEAM-HEATED TAINTER GATES

Aside from the greater height at which the gates are set, the four-Tainter-gate spillway at Junction Dam does not differ essentially from numerous similar spillways built in various parts of America. However, the severe winter conditions of this locality require that one of the spillway gates be provided with a heating system so that there will be no delay in opening a gate. When one of the gates has been opened and water allowed to flow for a few hours the circulation will thaw the ice on the remaining gates. The scheme of heating is to warm an inclosed chamber between the gate piers, having such shape and size as to permit the opening of the gate within the chamber. The steam radiators are supported on the upper radial struts of the gate and swing with it, the connection to the steam main being by a 2-in. (5.1-cm.) flexible hose. Steam is supplied from the low-pressure boiler of the power-plant heating system.

This foregoing scheme of heating has the advantage of applying heat directly to the surface of headwater about 2 ft. (60.9 cm.) in width between the curtain wall and the gate itself. The detail plan would not be applicable to a dam at which the headwater was allowed to rise above a fixed elevation, but at this plant the uniform flow of the Manistee River permits maintaining the headwater at a constant elevation.

Each of the three wheel chambers is closed by a steel Tainter headgate 30 ft. (9.1 m.) wide by 22 ft. (6.7 m.) in vertical height. Like the spillway Tainter gates, these headgates are hoisted directly by motor-driven worm-geared hoists without the aid of any counterweights. The hoists are operated from the power-house switchboard, where telltales in sight of the operator



FIGS. 1 AND 2—SECTION OF DAM THROUGH SPILLWAY, SHOWING TUMBLE-BAY AND SECTION THROUGH WATERWHEEL CHAMBER

indicate the position of the gate. Owing to the large size of these headgates the water can pass at a velocity of 2.57 ft. (78.3 cm.) per second. From the racks to the turbines the form of the water passages is such that the water moves very smoothly, making it possible to use turbine current meters very successfully for measuring waterwheel efficiencies. For making such tests the current meter sections are taken 4 ft. (1.2 m.) downstream from the racks at the headwater level, the vertical being 10 ft. (3.05 m.) from the racks at the bottom.

How Sizes of Units Were Chosen

The entire rating of the power house is now provided for by three vertical direct-connected generating units. The turbines, which are of the single-runner type, were built by the Wellman-Seaver-Morgan Company. At 47-ft. (14.3-m.) working head and when all three units are running full load 1700 cu.ft. (48.3 cu.m.) of water is used per second per unit. With the size of units chosen one of the three turbines will utilize the entire flow of the river at low water, and the three will take care of the ordinary flood flow.

Although the guaranteed efficiency of the water wheels is 88 per cent maximum, careful field efficiency tests indicated that they exceed this amount by 4 per cent. A very flat curve was obtained, the efficiency of the generators being 96.7 per cent maximum and 96.5 per cent at full load. From 0.4 load to full load the waterwheels show an efficiency above 80 per cent. No shop tests were made, owing to war conditions; that is, the shops were so crowded that time could not be taken to make tests.

The generators, which are rated at 5500 kw., 30-cycle and 75 r.p.m., and all electrical equipment were furnished by the Westinghouse Electric & Manufacturing Company. The rotor spiders are cast steel and guaranteed to stand 100 per cent overspeed. The flywheel effect is 3,400,000 ft.-lb. (469,000 m.kg.) at 1 ft. (0.305 m.) radius. A frequency of 30 cycles was selected because that is the periodicity in the northwest portion of Michigan, although 60 cycles is the frequency of all plants of the Consumers' Power Company south and east of Grand Rapids.

On top of each generator is a Kingsbury thrust bearing, which supports the rotating elements of both generator and turbine. On the shaft above the thrust bearing is a direct-connected compound-wound exciter rated at 55 kw. and 250 volts. The speed of the units is controlled by hydraulic governors built by the Lombard Governor Company, each having a capacity of 60,000 ft.-lb. (8270 m.kg.). The actuators are of a special new type operated by oil pressure, both for direct application and through the hand control directly from the actuator as well as on a separate stand. A central oil-

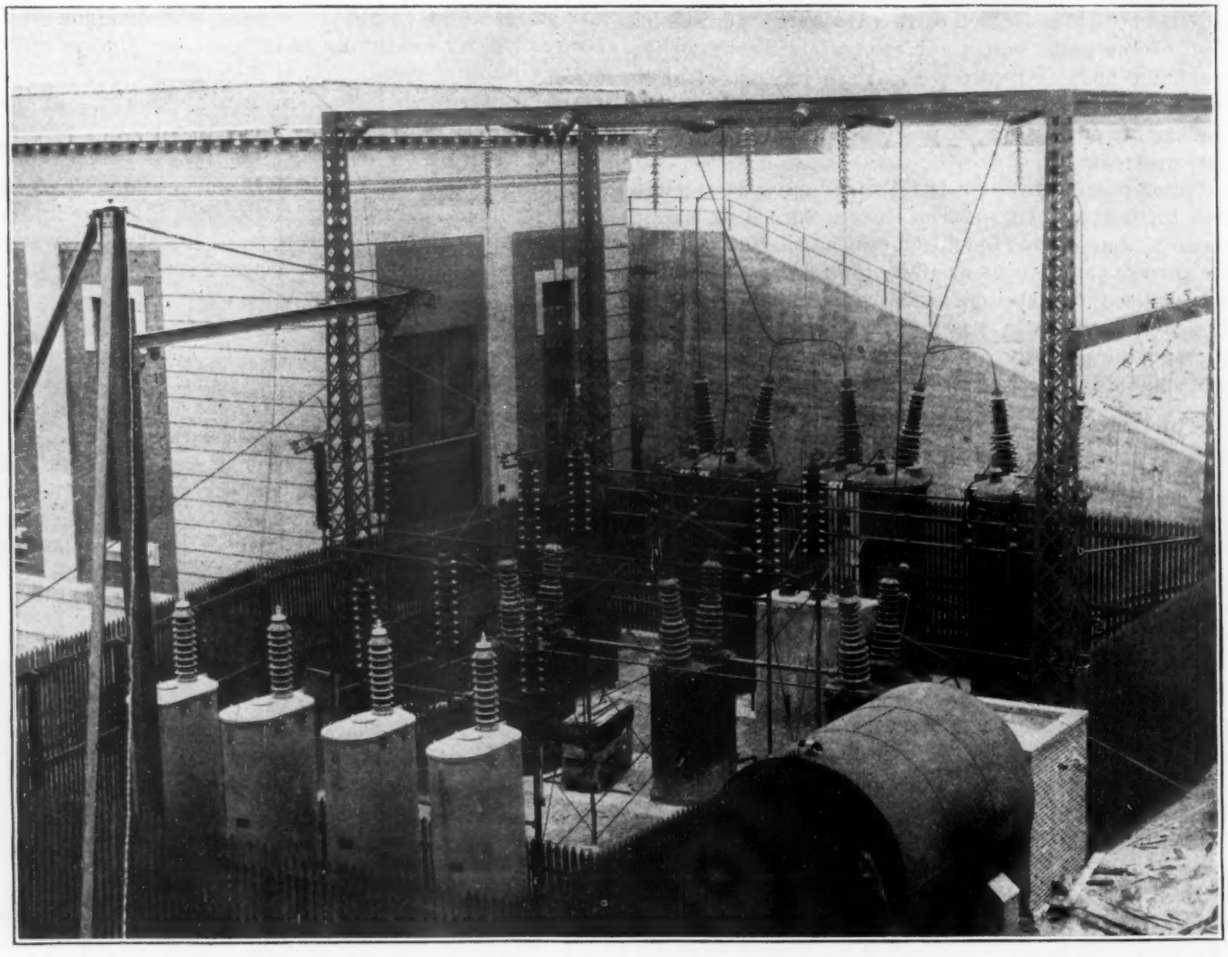


FIG. 3—OUTDOOR TRANSFORMING, SWITCHING AND LIGHTNING ARRESTER EQUIPMENT CONNECTED WITH 140,000-VOLT LINE TO GRAND RAPIDS

pressure system is used, two pumps being provided, either of which is sufficient for the three units. For filtering the oil used for this purpose as well as for lubrication, Richardson-Phenix equipment rated at 100 gal. to 200 gal. (378.5 l. to 757 l.) per hour is provided.

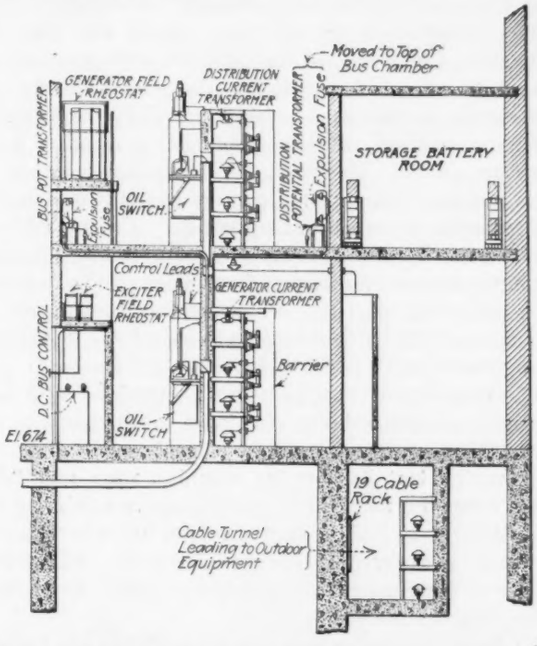


FIG. 4—DETAILS OF BUS AND SWITCH STRUCTURE WITH CABLE TUNNEL LEADING TO OUTDOOR EQUIPMENT

Keeping oil clean and conserving oil are considered so important by the engineers connected with this development that they even go so far as to say that all large water and steam power plants should have adequate oil-filter systems. The system mentioned has been quite satisfactory in other plants which the same engineers have designed.

The power house is served by a 30-ton Whiting crane, which can be used at 50 per cent overload for occasional handling of the generator rotors. The heaviest parts of the transformers are lighter than the rotors.

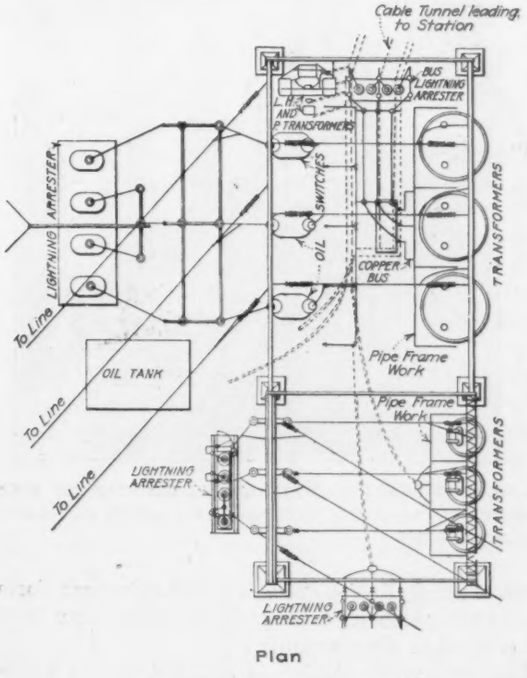
SWITCHING AND BUS LAYOUT TO SAVE EXPENSIVE BUILDING CONSTRUCTION

At the shore end of the power house is an inclosure, on the first floor of which, immediately back of the switchboard, are the generator-bus and oil-switch compartments. Back of these against the outside wall of the building is a small shop for repair work. Over the shop on the second floor is a storage-battery room, and next to it are the distribution bus and switch compartments and generator-field rheostats. The switchboard, which as mentioned before is at the end of the generator room, is made up of ten panels, of which two are for future outgoing lines.

The exciter rheostats are hand-operated and are situated on a platform to the rear of and immediately above the switchboard. The generator-field rheostats are motor-operated and are on an elevated platform on the second floor, above the switchboard. The storage battery, which is used only for energizing control circuits, consists of sixty cells rated at 112.5 amp.-hr. It is charged by a 2.25-kw. motor-generator set, the control panel of which is on the main floor to the right of switchboard.

The entire layout of the station switchboard and switching apparatus was arranged principally to save space and to avoid the unnecessary expense of enlarging the power house on the downstream side, where to support it over the tailrace would be expensive. With but three units it was entirely feasible to install the switchboard at the end of the station and still provide an ample passageway to the main entrance without unduly widening the power house.

All cables are carried in wrought-iron pipe conduits placed mostly in the concrete floors and walls. From the main generator to the oil switches the circuits are 500,000-circ.mil. lead-covered cables. The switches are type E-6 Westinghouse solenoid-operated 7500-volt, 600-amp. units. Cables run from these through the wall in the rear to current transformers mounted vertically and



Plan

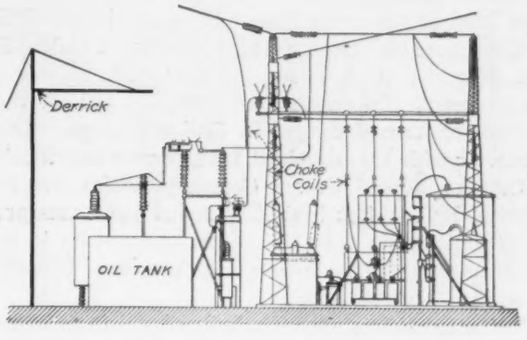


FIG. 5—ULTIMATE LAYOUT OF OUTDOOR EQUIPMENT, SHOWING DERRICK FOR HANDLING ARRESTER CONES

thence to "disconnects" and the main buses. The buses are separated by freestone barriers, these being used in place of concrete or "asbestocel," as they are cheaper and at the same time fully as satisfactory if not more so. Usually, thin concrete work, the engineers believe, is

much more expensive to build and finish in an attractive manner than is figured in the drawing room. The generator-bus potential transformers are located on the second floor, above the switchboard.

Various circuits are taken off from the generator buses through "disconnects" and current transformers to Westinghouse type E-6 solenoid-operated oil switches, which are immediately above the generator bus. The distribution potential transformers are above the busbar compartment. The circuits extend from their respective oil switches to a concrete subway running from the basement of the power house to an outdoor substation. This subway is 6 ft. (1.8 m.) wide by 9 ft. (2.7 m.) high. On one side are compartments with freestone barriers for 7500-volt circuits, 2000-amp. feeding the

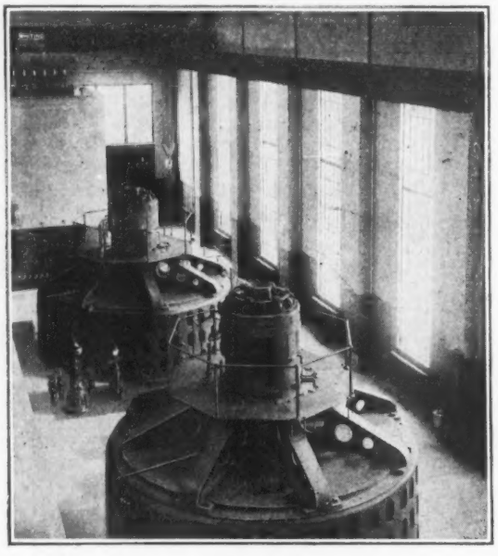


FIG. 6—TWO 5500-KW. WATERWHEEL GENERATORS; SWITCHBOARD IS IN BACKGROUND AGAINST WALL OF BUS AND SWITCH COMPARTMENT

Croton-Grand Rapids 7500/140,000-volt transformers. On the other side are cable racks for other circuits which are carried in fiber conduit.

The outdoor substation is situated to the landward and partly downstream from the generator house on the same level as the main floor. Here are installed three Westinghouse delta-connected 5000-kva., 140,000/7500-volt, 30-cycle, single-phase, oil-insulated, water-cooled transformers. On each transformer are 120,000-volt to 140,000-volt taps arranged in 5000-volt steps. This is in accord with the standard transformer specifications of the Consumers' Power Company, which are made essential by the fact that it is sometimes necessary to adjust voltages in order to secure best results in delivery of energy. "Disconnects" are placed at transformers in the 7500-volt leads.

The transformers are mounted on trucks supported on slightly elevated concrete platforms. To permit repairing and inspecting the transformers without exposing them to the weather a transfer-lorry track is provided between the substation and the power house. In the latter is a pit into which a transformer may be lowered before removing the core. With this arrangement extra headroom is not necessary.

None of the recent large stations of the Consumers' Power Company has a spare transformer. When repairs are made it is the custom to operate the transformers in open delta, readily separable joints being provided to permit their disconnection. All high-tension buses consist of galvanized-iron pipe mounted on a galvanized-steel structure with strain insulators for supports.

The 140,000-volt oil switches, which are type G-2 200-amp. units, are non-automatic, solenoid-operated and are set on concrete foundations. Automatic switches are undesirable in this case because the Consumers' Power Company employs the load-dispatcher method of operating its plants. However, the generator switches become automatic during the process of synchronizing on the insertion of synchronizing plugs. The 140,000-volt electrolytic lightning arresters with their horn-gap structure are set on concrete foundations and are served by a cone-stack derrick. Provision has been made for extension of the outdoor station to care for a 40,000-volt Manistee-Stronach-Cadillac transmission line.

The transformer cooling water is provided by a 2-in. (5.1-cm.) centrifugal pump having a capacity of 125 gal. (473.2 l.) per minute. It is directly connected to a 5-hp. motor installed in the machine shop and takes water from the penstocks. All piping to and from the transformers is laid in concrete trenches where necessary and is covered to prevent freezing. The transformer cooling-water indicator is a cast-iron box with a water-tight glass cover.

Oil for the transformers and oil switches can be supplied by an 1.5-in. (5.9-cm.) centrifugal pump having a capacity of 70 gal. (265 l.) per minute, directly connected to a 5-hp. motor. It is connected with a storage tank holding 8800 gal. (331 l.), and the pipes and valves are so arranged that oil can be pumped into the transformers or oil switches from the storage tank or oil barrels, or vice versa. All of this equipment is installed in the outdoor substation. A portable oil-filter press with a transformer attached is available and is used at other plants in the system. Three 25-kva., 7500/220-volt, 30-cycle, single-phase transformers are also installed in the outdoor substation to supply power for small station auxiliaries and local lighting.

ORGANIZATION OF PROJECT

Junction Dam was built by the Consumers' Power Company with its own forces and equipment. This company is a subsidiary of the Commonwealth Power, Railway & Light Company, which is managed by Hodenpyl, Hardy & Company of New York and E. W. Clark & Company of Philadelphia. B. C. Cobb, vice-president of Hodenpyl, Hardy & Company, is president of the Consumers' Power Company and represented these companies in connection with this work; Frank Silliman, Jr., of E. W. Clark & Company, represented that company. J. B. Foote, chief engineer of the Consumers' Power Company, was in general charge of the design and construction of this plant. G. S. Cochran was general construction superintendent, and the resident superintendent was Fred B. Taylor. George F. Stecker was in charge of the electrical part of the design and construction. The hydraulic and structural design and engineering supervision of construction, except for electrical features, was in charge of the Fargo Engineering Company of Jackson. H. N. Tuley was resident engineer.

Characteristics of Iron and Steel Conductors—II

Stringing Tables Are Based Upon Extreme Weather Conditions, but Present Tendencies Toward Economy Dictate Cheaper Construction Where Warranted by Local Conditions of Climate and Service

BY CHARLES E. OAKES AND P. A. B. SAHM
Bureau of Standards, Washington, D. C.

THE mechanical characteristics of iron and steel wire and their bearing on the proper sags and tensions which should be used with such wire have received insufficient attention in the past, and it is thought that a discussion of these characteristics would be opportune. While the wire-stringing tables accompanying this article are based on extreme weather conditions, a method is given for obtaining sag or tension with less factor of safety by a simple calculation, using the standard stringing tables. This is an essential feature of such tables under war-time conditions.

In order to insure a reasonable return on the investment in iron or steel lines, which usually serve sparsely settled territories, cheap construction must be resorted to and span lengths increased to as great a length as will be justified when due consideration is given to the safety of the public and the service to be rendered. Since a great portion of these lines lies in rural districts or on private rights-of-way, the utility is given almost a free hand in construction, the principal places where special requirements for strength of construction must be observed being those where such lines cross railroads, signal lines or other power lines, or where poles are used in common with other utilities. In these special situations certain strength requirements should be met, and it is particularly for these cases that the following sags and tensions are given.

TABLE V—MECHANICAL DATA FOR IRON AND STEEL WIRES AND CABLES

Size, Nominal	Actual Diameter (In.)	Area (Sq.In.)	Elastic Limit E.B.B.	Elastic Limit B.B.	Elastic Limit Ordinary Grade Steel	Elastic Limit Siemens-Martin	Modulus of Elasticity E.B.B. and B.B.	Modulus of Elasticity Ordinary Grade Steel and Siemens-Martin
Stranded:								
½-in.	0.36	0.0792	1900	2100	2500	3400	19×10^6	21×10^6
3/8-in.	0.327	0.0654	1550	1700	1900	2400	19×10^6	21×10^6
¼-in.	0.249	0.0379	900	1000	1150	1500	19×10^6	21×10^6
Solid B.W.G.:								
No. 4	0.238	0.0445	1014	1135	1216	1670	26×10^6	29×10^6
No. 6	0.203	0.0324	737	826	885	1200	26×10^6	29×10^6
No. 8	0.165	0.0214	486	546	585	800	26×10^6	29×10^6

The coefficient of linear thermal expansion for iron and steel per degree F = 0.67×10^{-6}. The elastic limit was taken as one-half of the ultimate strength.

A method is also given by which stringing tensions for use on parts of the lines where no special hazard is involved may be obtained by the application of simple rules, using the sags of Table VII. The factor of safety based on the assumed conditions of loading given below may, by the application of these rules, be varied at will, although the computation of the factor of safety under these new conditions is difficult because the wire will usually be stressed beyond the elastic limit.

Not only should lines be given a sag such that the tension in adjacent spans will be approximately equal at the time of stringing, but for the smaller spans at least the sags should be about the same for all conductors, regardless of size. In every case an effort should be made to avoid giving the conductors on the lower crossarms the smaller sags.

The mechanical characteristics given in Table V have been used as the bases of calculations. The moduli of elasticity for the solid wire given in the table are the generally accepted values. The fabrication of the wire into cables will result in a somewhat different modulus for the stranded type of conductor. The effect of the wires lying together more closely under load also affects the resulting modulus of elasticity. From tests on one hundred samples made by the American Telephone & Telegraph Company on seven-strand steel cable, an average value of 21×10^6 for this cable resulted. Tests on seven-strand iron cable (E. B. B. and B. B.) conducted at the Bureau of Standards resulted in a value of 19×10^6. The loading under the most adverse condition was assumed to be the resultant loading at 0 deg. Fahr., due to the weight of the conductor plus the added weight of a layer of ice 0.5 in. (1.27 cm.) in radial thickness, combined vertically with a wind pressure of 8 lb. per sq.ft. (39 kg. per sq.m.) on the projected diameter of the ice-covered conductor.

Table VI gives the loadings under the above assumptions for different-size conductors, while Tables VII and VIII give sags and tensions for various temperatures under which the wire might be strung. The sags are computed on the assumption that the maximum stress in the wire will be 0.9 of the elastic limit of the wire under consideration when under the most adverse condition defined above.

It is obvious that under this condition the tension in the wire will be as large for the short spans as for long ones. The strength of the structures for such spans must, in order to withstand these stresses, be comparable to the strength of structures for long spans. Consequently the advantage of using short spans is lost. The sags for the shorter spans should therefore be increased. Further reasons for this will appear later.

When considering sags for short spans, attention should be given to the possibility of later replacing the iron-wire lines by copper lines and also to the probability of using iron and copper conductors on the same pole structure. In order to eliminate a ragged appearance in the line, all conductors should be given about the

TABLE VI—CONDUCTOR LOADINGS

Nominal Size	Weight of Conductor in Lb. per Ft.	Resultant Loadings in Lb. per Ft. at 0 Deg. Fahr., 8-Lb. Wind and ½ In. of Ice Plus Weight of Conductor
½-in.	0.295	1.25
3/8-in.	0.21	1.142
¼-in.	0.125	1.022
Solid B.W.G.:		
No. 4	0.153	1.027
No. 6	0.112	0.972
No. 8	0.074	0.917

TABLE VII—STRINGING SAGS FOR IRON AND STEEL CONDUCTORS (IN INCHES)

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	EXTRA BEST BEST (E.B.B.) IRON WIRE — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	25.5	43	65.5	92	123	199					
	30	27	45	67.5	92.4	125	202					
	60	29.5	47	68	95.5	127	203					
	90	31.5	48.5	71	97	128	204					
	120	32.5	50.5	72.5	99	130	206					
No. 6 B.W.G.	0	12	25	40.5	59	83.5	132	196				
	30	15.5	28	43.5	61.5	86	134	199				
	60	18.5	31	46	64.5	88.5	137	201				
	90	21	33.5	48.5	67	91	140	202				
	120	23	35.5	51	69	93	142	205				
No. 4 B.W.G.	0	6.1	14.5	26.5	40.5	59	96	143.5	269			
	30	9.2	18.5	30.5	44	63	99.5	147	272			
	60	12.5	22	33.5	47.5	66	102	150.5	275			
	90	16	26	37	51	69.5	105.5	153.5	278.5			
	120	18.5	28.5	40	54	73	109	156.5	281			
¼-in. seven-strand cable	0	5.1	13.5	27	43	61.5	105.5	159.5	301			
	30	7.3	17	30.5	46.5	64.5	109	162.5	305			
	60	10.2	21	34	49.5	68	111.5	165.5	308			
	90	13.5	24	37	53	71	116	168.5	310			
	120	16.5	27	40	56	74	117.5	171.5	313			
7/16-in. seven-strand cable	0	3	5.5	9.9	17.5	28	56	92.5	179	295	439	
	30	3.8	7.2	13	22	33	61	95.5	183.5	300	444	
	60	5.1	9.9	17	26.5	38	66	103	188	304	448	
	90	7.4	13.4	21.5	31	42.5	70.5	105	193	308	453	
	120	10.1	17	25.5	35.5	47	75	109	197	313	457	
½-in. seven-strand cable	0	3.2	5.6	9.4	15	21	47	77.5	155.5	258	385	540
	30	4	7.1	12	19	28.5	52.5	83	160.5	263	390	546
	60	5.2	9.3	15.5	23.5	33.5	57.5	88	165.5	268	395	549
	90	7.2	12.5	19	28	38	62.5	93	170.5	273	399	554
	120	9.9	16	23.5	32.5	42.5	67.5	98	176	278	405	559

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	BEST BEST IRON (B.B.) — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	19	35.5	55.5	79	106	173.5					
	30	21.5	38	57.5	81	108	175					
	60	24	40	59.5	83	110	177					
	90	26	42	61.5	85	112	179					
	120	28	44	63.5	87	114	181					
No. 6 B.W.G.	0	7.7	18.5	32.5	49	66.5	113.5	175.5				
	30	11	22	36	52	70	116.5	176.5				
	60	14	25.5	39	55	73	119.5	181				
	90	17.5	28.5	41	58	75.5	122	182				
	120	20	31	44.5	61	78.5	125	184.5				
No. 4 B.W.G.	0	4.1	9.4	19	32.5	46	82	123.5	234	379		
	30	6.1	13.3	24	37	50.5	85	127	237.5	383		
	60	9.2	17.5	27.5	40.5	54.5	88.5	131.5	241.5	386		
	90	12.7	21	31.5	44.5	58.1	92	135	244	390		
	120	16	24.5	35	48	61.5	96	138.5	248	394		
¼-in. seven-strand cable	0	3.6	8.3	18.5	33	50	89.5	138	265			
	30	4.8	11.4	23	37	53.5	93	141	268.5			
	60	6.7	15	27	41	57	96.5	144.5	271.5			
	90	9.5	18.8	30	44.5	61	100	148	275			
	120	12.5	22	34	48	64	104	152	278			
7/16-in. seven-strand cable	0	2.5	4.4	7.6	12.6	20.5	45	76	157	261	392	550
	30	3.1	5.6	9.7	16.5	25.5	50.5	81.5	161.5	266	398	555
	60	4	7.4	12.8	21	30.5	55.5	87	166.5	271	403	560
	90	5.6	10	17	25.5	35.5	61	92	171.5	276	407	564
	120	8	13.5	21	30	40.5	65.5	96.5	176.5	281	412	469
½-in. seven-strand cable	0	2.7	4.5	7.4	11.6	17.5	36.5	63	133	225	339	479
	30	3.2	5.7	9.3	14.5	21.5	42	69	139	231	345	483
	60	4.2	7.3	11.8	18	26.5	48	75	144.5	237	351	489
	90	5.6	9.6	15	22.5	31.5	53	80.5	150.5	242	356	493
	120	7.8	12.5	19	27	36	58.5	86	155.5	248	352	498

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	ORDINARY GRADE STEEL — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	17	32.5	51	73	98.5	160	238				
	30	19.5	35	53	75	100.5	162	240				
	60	22	37	55.5	77.5	102	164	242				
	90	24.5	39.5	57.5	79.5	105	167	244				
	120	26.5	41.5	59.5	81.5	106.5	169	246				
No. 6 B.W.G.	0	6.1	16	29	44.5	62.5	105.5	153	294			
	30	9.4	20	33	48	65	108	160	296			
	60	13	23.5	36.5	51	69	111.5	163	299			
	90	16	26.5	39.5	54.5	72	114	166	303			
	120	19	29.5	42	57	74.5	117.5	169	306			
No. 4 B.W.G.	0	3.5	7.9	16.5	28	41.5	74	114	215	350		
	30	5.3	11.7	21	33	46	78.5	118	220	354		
	60	8.4	16	25.5	37	50.5	82.5	122	224	358		
	90	12	20	29.5	41	54.5	86	125.5	228	362		
	120	15.3	23.5	33	44.5	58	90	129	231	366		
¼-in. seven-strand cable	0	2.6	5.3	12.5	21.5	36	71	113	221	358		
	30	3.3	7.1	16.5	26.5	41	75.5	117	225	362		
	60	4.5	9.8	21	31	45.5	79.5	121	230	366		
	90	6.4	13.5	25	35.5	49.5	83.5	125	233	370		
	120	9.4	17.5	27.5	39.5	53.5	87	129	237	374		
7/16-in. seven-strand cable	0	2.2	3.7	6	8.9	15	34	62	139	226	342	482
	30	2.6	4.6	7.7	11.5	19.5	40	68	147.5	232	348	487
	60	3.4	6	10.1	15	24.5	46.5	74	152	237.5	353	492
	90	4.6	7	13.7	19.5	29	52	80	156	243	359	497
	120	6.7	11.6	18	24.5	35	57.5	85.5	162	249	364	502
½-in. seven-strand cable	0	2.2	3.6	5.5	8.2	11.8	23.5	42.7	100	177	271	384
	30	2.6	4.3	6.7	10	14.5	28.5	49.5	107	184	277	391
	60	3.2	5.3	8.4	12.5	18	34	56	114	190	284	398
	90	4.1	6.9	10.8	16	22.5	40	62.5	121	197	291	404
	120	5.6	9.3	14.2	20.5	27.5	45.5	68.5	127	204	297	411

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	SIEMENS-MARTIN STEEL — Length of Span (Feet)												
		100	125	150	175	200	250	300	400	500	600	700	800	1000
No. 8 B.W.G.	0	3.5	11.3	25.5	42	60.5	105.5	160	304					
	30	5.4	15.4	29.4	46	64	108.5	163	307					
	60	8.5	19.5	33	49	67.5	111.5	166	310					
	90	12.1	23	36.5	52	70.5	114.5	169	313.5					
	120	15.5	26	39.5	55	73.5	117.5	172	315.5					
No. 6 B.W.G.	0	2.1	4.3	8.9	18	31	62.5	101	201	329				
	30	2.9	6	12.7	23	36.5	67.5	105.5	205	334				
	60	4	8.9	17.5	28.5	41	72	110	209	337				
	90	6.6	13	22	33.5	45.7	76.5	114	213	341				
	120	9.7	17	26.4	36.4	50	80.5	118	217	345				
No. 4 B.W.G.	0	1.8	3.2	5.3	8.8	14.5	35	64	138	232	349			
	30	2.3	4.2	7	11.6	19.5	42	71	144	238	356			
	60	3.2	5.6	9.8	16	25	48	77	150	244	361			
	90	4.4	8.2	14	22	31	54	82	155	250	367			
	120	6.9	12	17	27	36	59	88	160	255	371			
¼-in. seven-strand cable	0	1.6	2.8	4.5	7.3	11.8	31	63.5	147	250	387			
	30	1.9	3.3	5.4	8.9	14.9	37	69.5	152	258.5	392			
	60	2.2	3.4	5.7	11.4	19	43.5	74.5	158	264	397			
	90	2.7	5	8.6	14.8	24	49	81	164	269	402			
	120	3.5	6.5	11.5	19	29	54.5	85.5	168	274	405			
7/16-in. seven-strand cable	0	1.6	2.6	3.9	5.7	8.1	15.5	29.5	81.5	154.5	245	357		
	30	1.8	3	4.8	6.8	9.7	19	36	89	162	252	360		
	60	2.2	3.6	5.6	8.2	12	23.5	42.5	97.5	170	260	367		
	90	2.7	4.5	7	10.4	15	29	49.5	105	177	267	374		
	120	3.4	5.8	9	13.5	19.4	35	56.5	112	184	274	381		
½-in. seven-strand cable	0	1.5	2.4	3.5	5	6.7	11.5	18.5	44.5	87	159.5	236	335	566
	30	1.7	2.7	4	5.9	7.7	13.5	21.5	51.5	102.5	169	250	345	576
	60	1.9	3.1	4.6	6.5	8.9	15.5	25.5	59	111	178.5	260	354	586
	90	2.2	3.6	5.4	7.7	10.5	18.4	30	67	124	188	268	363	594
	120	2.7	4.4	6.5	9.3	12.7	20.5	35.5	75	129.5	197	278	372	602

TABLE VIII—STRINGING TENSIONS FOR IRON AND STEEL CONDUCTORS (IN POUNDS)

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	EXTRA BEST BEST (E.B.B.) IRON WIRE — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	44	41	39	38	37	36	...	...	...	...	...
	30	41	39	38	37	36	36	...	...	...	...	...
	60	38	37	37	36	36	36	...	...	...	...	...
	90	36	36	36	36	36	36	...	...	...	...	...
	120	34	35	35	35	35	35	...	...	...	...	...
No. 6 B.W.G.	0	137	105	93	88	82	81	80	...	...	...	...
	30	109	94	87	84	79	80	79	...	...	...	...
	60	91	86	83	81	77	78	78	...	...	...	...
	90	80	79	78	78	75	77	77	...	...	...	...
	120	73	74	75	75	73	76	76	...	...	...	...
No. 4 B.W.G.	0	367	246	195	174	163	151	146	141	...	...	...
	30	250	193	171	160	153	146	143	139	...	...	...
	60	181	162	153	148	145	141	140	138	...	...	...
	90	145	139	140	139	138	137	137	136	...	...	...
	120	123	126	129	131	132	133	134	135	...	...	...
¼-in. seven-strand cable	0	366	208	157	134	123	112	108	103	...	...	...
	30	258	169	138	124	119	109	106	102	...	...	...
	60	183	141	124	116	113	106	104	101	...	...	...
	90	140	132	114	109	107	104	102	101	...	...	...
	120	114	108	105	104	102	101	100	100	...	...	...
5/16-in. seven-strand cable	0	1069	898	713	556	450	353	315	285	272	267	...
	30	832	682	541	440	380	323	299	278	268	265	...
	60	611	499	413	364	332	300	285	272	265	262	...
	90	426	368	332	310	296	280	272	266	262	260	...
	120	311	287	278	273	269	264	262	259	258	258	...
⅜-in. seven-strand cable	0	1404	1244	1060	891	752	590	517	458	435	426	418
	30	1117	975	832	710	623	529	483	445	428	420	414
	60	847	740	645	578	532	481	455	431	420	415	410
	90	614	555	518	485	465	443	431	418	412	412	407
	120	445	433	426	420	417	413	409	407	406	405	404

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	BEST BEST (B.B.) IRON WIRE — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	58	49	45	44	43	41	...	...	...	...	...
	30	51	46	44	43	42	41	...	...	...	...	...
	60	47	44	42	42	41	40	...	...	...	...	...
	90	43	42	41	41	40	40	...	...	...	...	...
	120	40	40	40	40	40	40	...	...	...	...	...
No. 6 B.W.G.	0	218	142	116	106	102	94	89	...	...	...	...
	30	155	119	105	99	97	91	88	...	...	...	...
	60	118	104	97	94	93	89	86	...	...	...	...
	90	97	93	91	89	90	97	85	...	...	...	...
	120	84	85	85	85	87	85	84	...	...	...	...
No. 4 B.W.G.	0	569	380	269	217	199	178	168	161	157	...	...
	30	378	270	219	192	183	170	164	158	156	...	...
	60	250	207	186	173	169	163	159	156	155	...	...
	90	181	170	164	159	159	157	155	154	153	...	...
	120	145	146	148	148	150	151	151	152	152	...	...
¼-in. seven-strand cable	0	528	351	227	175	152	132	124	117	...	...	...
	30	396	257	185	155	141	127	121	115	...	...	...
	60	281	195	158	141	132	122	118	114	...	...	...
	90	197	156	139	129	125	119	115	113	...	...	...
	120	148	132	125	121	118	114	113	112	...	...	...
5/16-in. seven-strand cable	0	1255	1110	940	763	615	442	375	325	307	297	292
	30	1015	876	731	593	494	392	349	315	301	294	290
	60	779	661	552	465	412	354	328	305	296	290	288
	90	564	482	422	381	354	324	310	297	291	287	286
	120	392	358	336	322	312	302	295	289	286	284	283
⅜-in. seven-strand cable	0	1633	1500	1340	1171	1005	759	633	533	497	480	468
	30	1342	1219	1073	938	815	656	577	512	485	472	464
	60	1057	950	840	746	671	579	533	491	474	465	459
	90	794	720	652	602	565	520	497	473	464	458	454
	120	570	544	519	503	493	474	467	457	454	451	450

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	ORDINARY GRADE STEEL — Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	66	54	50	47	46	45	44	...	...	...	...
	30	57	50	47	46	45	44	43	...	...	...	...
	60	50	47	45	44	44	43	43	...	...	...	...
	90	46	44	44	43	43	43	43	...	...	...	...
	120	42	42	42	42	42	42	42	...	...	...	...
No. 6 B.W.G.	0	276	164	130	116	109	101	98	95	...	...	...
	30	178	132	116	108	103	98	96	94	...	...	...
	60	130	112	105	101	98	95	94	93	...	...	...
	90	104	99	97	95	94	93	93	92	...	...	...
	120	89	90	90	91	91	91	91	91	...	...	...
No. 4 B.W.G.	0	653	453	316	252	221	195	183	173	169	...	...
	30	431	306	247	215	199	184	177	170	167	...	...
	60	274	226	204	190	183	175	171	167	166	...	...
	90	191	181	177	172	170	167	166	165	164	...	...
	120	150	154	157	158	159	160	161	162	162	...	...
½-in. seven-strand cable	0	719	553	336	264	208	166	150	138	135	...	...
	30	566	415	254	216	183	156	145	136	134	...	...
	60	419	298	201	185	166	148	140	134	133	...	...
	90	291	218	168	162	152	141	136	132	131	...	...
	120	200	170	146	146	141	135	132	130	130	...	...
5/8-in. seven-strand cable	0	1467	1330	1170	1082	830	579	460	365	353	338	331
	30	1192	1070	924	840	649	491	416	351	345	333	328
	60	931	819	698	640	514	426	384	338	336	328	325
	90	729	701	518	491	422	380	356	326	329	323	322
	120	468	426	396	392	360	344	334	315	321	319	318
¾-in. seven-strand cable	0	2050	1930	1798	1659	1499	1178	934	710	630	596	577
	30	1720	1616	1494	1360	1220	971	807	663	606	582	568
	60	1398	1302	1194	1081	977	811	711	623	586	569	558
	90	1085	1003	923	848	783	692	639	590	567	558	548
	120	790	749	705	669	642	604	582	560	549	545	540

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	SIEMENS-MARTIN STEEL — Length of Span (Feet)												
		100	125	150	175	200	250	300	400	500	600	700	800	1000
No. 8 B.W.G.	0	316	154	98	81	74	67	64	61	...	...	...	...	...
	30	207	112	85	74	70	65	63	60	...	...	...	...	...
	60	131	89	76	70	66	63	61	59	...	...	...	...	...
	90	92	75	69	66	64	61	60	59	...	...	...	...	...
	120	72	66	64	62	61	60	59	59	...	...	...	...	...
No. 6 B.W.G.	0	772	605	425	287	218	168	150	136	131	...	...	...	...
	30	586	440	298	218	185	156	144	134	130	...	...	...	...
	60	414	295	218	182	163	147	139	131	129	...	...	...	...
	90	266	203	172	155	147	138	134	129	127	...	...	...	...
	120	173	154	144	141	135	131	129	126	126	...	...	...	...
No. 4 B.W.G.	0	1269	1132	973	800	633	406	323	269	250	241	...	...	...
	30	1011	881	737	591	472	344	294	258	244	238	...	...	...
	60	759	644	525	431	365	299	271	248	239	233	...	...	...
	90	525	438	371	328	298	267	252	239	234	231	...	...	...
	120	333	299	276	263	274	243	237	231	229	228	...	...	...
½-in. seven-strand cable	0	1160	1053	931	788	635	376	268	206	191	179	...	...	...
	30	1003	895	779	641	505	315	244	199	184	177	...	...	...
	60	845	740	628	505	396	272	225	192	181	175	...	...	...
	90	689	590	488	389	314	249	210	186	178	173	...	...	...
	120	536	447	366	300	258	215	198	181	175	171	...	...	...
5/8-in. seven-strand cable	0	2000	1920	1815	1696	1559	1257	958	621	513	467	445	...	...
	30	1730	1650	1546	1430	1300	1030	794	567	488	454	436	...	...
	60	1458	1378	1280	1172	1058	832	666	520	466	442	428	...	...
	90	1189	1113	1025	931	830	675	573	483	447	430	421	...	...
	120	928	859	786	717	651	560	504	452	431	420	414	...	...
¾-in. seven-strand cable	0	2950	2890	2818	2726	2632	2400	2134	1582	1198	1005	907	856	799
	30	2620	2558	2490	2400	2306	2086	1840	1374	1082	946	872	832	786
	60	2288	2230	2160	2080	1990	1783	1569	1199	996	897	842	810	770
	90	1957	1901	1839	1761	1680	1500	1322	1058	921	852	814	790	762
	120	1630	1508	1522	1452	1389	1365	1114	945	857	813	787	772	751

same sag, which must be that of the smallest conductors. This will also prevent the conductors swinging together. It is recommended that for spans below 150 ft. (45.7 m.), where there is a probability of using iron and copper conductors on the same structure, the sags recommended by the National Electrical Safety Code for bare hard-drawn copper wire of the same or the nearest cross-section be used, except where the sags specified in Table VII are greater than those of the National Electrical Safety Code. In such cases the sags specified in Table VII should be used for both the iron and copper conductors.

The sags for the steel conductors, especially in the shorter span lengths, are very small and the corresponding tensions are large. While the stresses which would occur under the most adverse conditions would not exceed the elastic limit of the material, it is not practicable to pull the wires to such small sags. This constitutes still another argument in favor of using the sag tables for copper wire for such cases. A greater uniformity in line construction, which is most desirable, will thus be secured.

Inasmuch as iron wire lines are commonly built only in rural districts, so that continuity of service is not usually of prime importance, the sags specified above can be considerably reduced for long spans in other than the hazardous situations outlined earlier without reducing the factor of safety unduly. While a reduction of 25 per cent in the sags specified above will result in stresses which will be greater than the elastic limit of the material, provided that the loading assumed above is experienced, the stretch to which the wire will be subjected will immediately relieve the tension and the conductor will not break. However, it will suffer a permanent elongation and therefore a permanent increase in sag.

If it is desired to use a smaller sag on the portions of the line where no special hazard is involved, it will be necessary to compute the corresponding stringing tensions, using the tensions of Table VIII as a basis. The following method will prove sufficiently accurate for the purpose:

If the curve which the conductor takes is assumed as a parabola, the equation of the curve will be of the form $d = Wl^2/8P$, where d is the deflection, l is the span length, W is the loading per foot and P is the tension in the conductor at the lowest point. The stringing tension will never in the practical case reach the elastic limit of the material, so that in the above equation, if the weight per foot, W, and the span length, l, are constant, the sag will be inversely proportional to the tension in the conductor. Using this relation and the sag and tension tables, VII and VIII, stringing tensions for any chosen sag can be computed readily.

The increase in sag due to the permanent increase in length when the conductor is stressed above the elastic limit is usually not a serious matter, as there is seldom more than one circuit on such lines, and hence there is no danger of wires blowing together and creating a hazard. Recognition of such a possibility should be made, however, and attention should be given in the design of the line to the provision of adequate clearances. If the provisions of Rules 241 and 242 of the National Electrical Safety Code are complied with, no trouble will be experienced with this feature in the design of such lines.

Corrections for Tables I and II, "Characteristics of Iron and Steel Conductors"

The following corrections should be made in Tables I and II, printed in the ELECTRICAL WORLD for July 27, 1918, page 150:

	Range of Current	a	b
TABLE I:			
¼-in. seven-strand ordinary grade steel	0–5	9.7	0.062
No. 4 B.W.G. solid, B.B.	0–2	7.1	0.65
TABLE II:			d
¼-in. seven-strand ordinary grade steel	0–5		0.24
5/16-in. seven-strand E.B.B.	0–3		0.40
5/16-in. seven-strand B. B.	0–7		0.186
5/16-in. seven-strand ordinary grade steel	0–2		0.18
	2–20		0.104
¼-in. E. B. B. seven-strand	5–12		0.179
	12–18		0.228
¼-in. seven-strand ordinary grade steel	0–5		0.24
¼-in. seven-strand Siemens-Martin	0–1.7		0.71
No. 6 solid B. W. G., E. B. B.	4–8		0.1

ELECTRICAL INDUSTRY IN THE ENEMY COUNTRY

Report of the Department of Commerce on Manufacturing Developments in Germany—Central Station for Hanover

A report on "German Trade and the War," by Chauncey Depew Snow and J. J. Kral, published by the Department of Commerce, says in regard to the electrical industry:

The electrical industry is concentrated in the hands of a few gigantic firms or combines which are related or have working agreements, so that the exploitation of foreign business is greatly facilitated. The Allgemeine Elektrizitäts-Gesellschaft of Berlin, capitalized at 155,000,000 marks, has branches all over the world and also working agreements with large electrical undertakings abroad, and the other large concerns, Siemens-Halske and Siemens-Schuckert, have similar connections. In 1913 the exports of electrochemical products from Germany were valued at $69,082,000. The chief products exported were appliances for illumination, transmission of power, electrolysis, etc., valued at $17,623,000, and incandescent lamps—chiefly metallic-filament lamps—valued at $11,451,000. In 1912 Germany produced 97,161,000 incandescent lamps, imported 2,294,000, and exported 58,339,000. The exports declined somewhat in 1913. The electric concerns have also worked for military needs, and the Allgemeine Electrizitäts-Gesellschaft was able to increase its net profits during the first year of the war to 26,570,000 marks, as against 18,163,000 in 1913-14. The net profits for 1915-16 were 26,487,000 marks, and for 1916-17 29,574,000 marks. The capital of the company was increased to 184,000,000 marks in 1916-17. The shares of the company were quoted at 232 at the end of 1917.

The electrotechnical factory of Max Schorch at Rheydt, which had been paying 8 per cent during the years 1910 and 1913, increased its dividend to 12 per cent in 1914. The factories of the company were fully employed during the war, night shifts being necessary at times. In 1915 the turnover was five times as large as in the preceding years, and the company distributed a dividend of 20 per cent with a bonus of one new share for every two old shares, thus really paying a dividend of 70 per cent.

In Bavaria and Saxony steps have been taken to make the production of electric power a state monopoly. This action would seem to make impossible the institution of an imperial monopoly of electricity.

In December, 1917, the government of Prussia announced its intention to build a large central plant in Hanover for the production of electric energy. The initial production is estimated at 50,000,000 kilowatt-hours. The state is ultimately to monopolize the production of electric energy, though not its distribution. The existing private and municipal works may remain in operation, and the state is to seek close coöperation with them.

Motor Drive for Woodworking Machinery

Induction Motors Are Used Extensively for the Purpose of Timber Sawing and Planing—Power Requirements of Typical Machines—Examples of Successful Motor Applications

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

MOTOR and industrial controller manufacturers have done very much to compile accurate data and classify information regarding the most advantageous motor applications for various departments of woodworking establishments. In addition they have investigated and gathered convincing information on the economies which may be effected in such plants by the motor in contrast to line-shaft operation. In conjunction with the analysis of the characteristics of the woodworking appliances from the mechanical point of view and the design and adaptation of motors to meet them successfully corresponding attention has been given to the best control devices for the motor equipment. It is, perhaps, not an exaggeration to add that these investigations of the motor manufacturers have resulted in a comprehensive grasp of the details of the power requirements in this industry which is considerably more definite than that possessed by the operators of these plants themselves.

The information presented in what follows is largely drawn from this fund that has been collected by manufacturers and also from other authoritative sources. Specific cases to be discussed below point to special features of various machines, such, for example, as the band saw for timber sawing where the heavy-duty starting requirements and a large flywheel effect in the band wheels make the proper selection of the control equipment positively essential to the successful operation of the motor.

Automatic starting and stopping controllers are widely used for these equipments, standard types, as discussed in the earlier articles on controller practice, being adaptable to the various needs of these plants. The common use of push-button stations is a noticeable feature of many of the machines. The additional safety insured for the operator by having such stations at various important points of planing-mill machinery will be evident by a reference to the illustrations in the present article.

The well-known advantages of automatic control as compared with hand devices, which have been shown to apply so generally to other industries, apply with equal weight to most of the machinery in these mills. Fig. 1 illustrates a bank of automatic control apparatus which is compactly arranged for numerous machines at one point and shows the possibilities of ready access for repairs and adjustments to the accelerating switches and auxiliaries.

DIRECT-CURRENT MOTORS

Little attention need be given to the use of direct-current motors for this work, their use for strictly woodworking machinery being limited usually to those plants which for some special reason possess a direct-current supply only. Motors of this type, however, are in successful operation in woodworking plants, and the steel frames and dust-proof bearings employed make them practically as reliable under the special conditions in such mills as those of the alternating-current type.

Some woodworking establishments may also have quite an extensive department devoted to metal-working machinery, and here the advantages of the direct-current adjustable-speed motor may not only make this type particularly desirable where a direct-current supply is at hand but may even make the installation of a motor-generator set an advantage where alternating current is the only supply available otherwise.

ALTERNATING-CURRENT MOTORS

The acceptance of the induction motor as the standard for woodworking machinery is evidenced by the fact

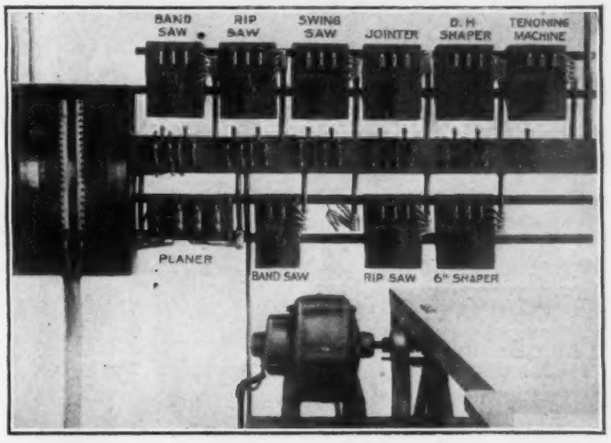


FIG. 1—BANK OF AUTOMATIC CONTROL EQUIPMENT IN A WOODWORKING ESTABLISHMENT

that practically no references are made to the use of direct-current motors in the handbook sections on this subject and that very little attention is given to any other than the induction type in standard manufacturers' bulletins which relate specifically to this industry.

The reasons for this almost universal adoption of the induction motor in these plants, either the squirrel-cage type or the wound-rotor form, are, first, of course, that its characteristics meet the service conditions of the driven machinery, coupled, second, with the further special advantages of the induction motor due to its simplicity, the absence of a commutator. the facility with which dust protection is afforded and cleaning may be accomplished, and the like.

As will be pointed out specifically below, low-slip motors of the squirrel-cage type furnish a drive with high-speed regulation which has been found to be more reliable than straight-line shaft drives, thus adding to the other advantages of the motor the possibility of

increased production. Obviously the squirrel-cage motor is preferable, where its characteristics meet the conditions, to the wound-rotor type.

Certain classes of woodworking machines, because of a high starting torque and the presence of large flywheel effect, are operated by the wound-rotor type because of its improved starting features both in high torque and lower starting current demands on the lines. Where fixed extra rotor resistance is required to insure the proper energy relations in the flywheel effect, an added advantage of the wound-rotor type is that this auxiliary resistance can be placed outside the motor, relieving the motor of just that much of the necessary heat radiation. The squirrel-cage motor may be equipped with additional internal resistance for accomplishing the same purpose, it is true, but here, conversely, the burden of extra heat radiation is thrown on the motor. Speed adjustment to a limited extent may be mentioned as an additional feature of the wound-rotor type which may prove useful in certain cases.

There are about fifteen or twenty distinct applications of the motor which may be made to the operations directly connected with, or auxiliary to, timber sawing. The use of band saws in preference to circular saws is one of the noticeable features of this part of the mill, and some of the characteristics of band saws may thus be taken as the basis for showing the corresponding characteristics of available motors for their successful operation. It is to be understood that any of the other more prominent machines in the timber-saving mill might be similarly treated and that the following notes are to be looked upon merely as typical.

Timber band saws operate with band wheels of great weight and may run at speeds of, say, 10,000 ft. (3000 m.) per minute. The large weight of the band wheels (a number of tons) and the high speeds result in heavy flywheel effects. Such mechanical features call for a large starting effort if the equipment is to be accelerated to its normal speed quickly. Even after normal operating speed is reached load peaks make it desirable to utilize the stored energy in the flywheel effect of the band wheel.

These characteristics may be met by a slip-ring motor with permanent resistance in the rotor circuit, after starting has been accomplished, to take care of the peaks of load, or a high-slip squirrel-cage motor may be used,

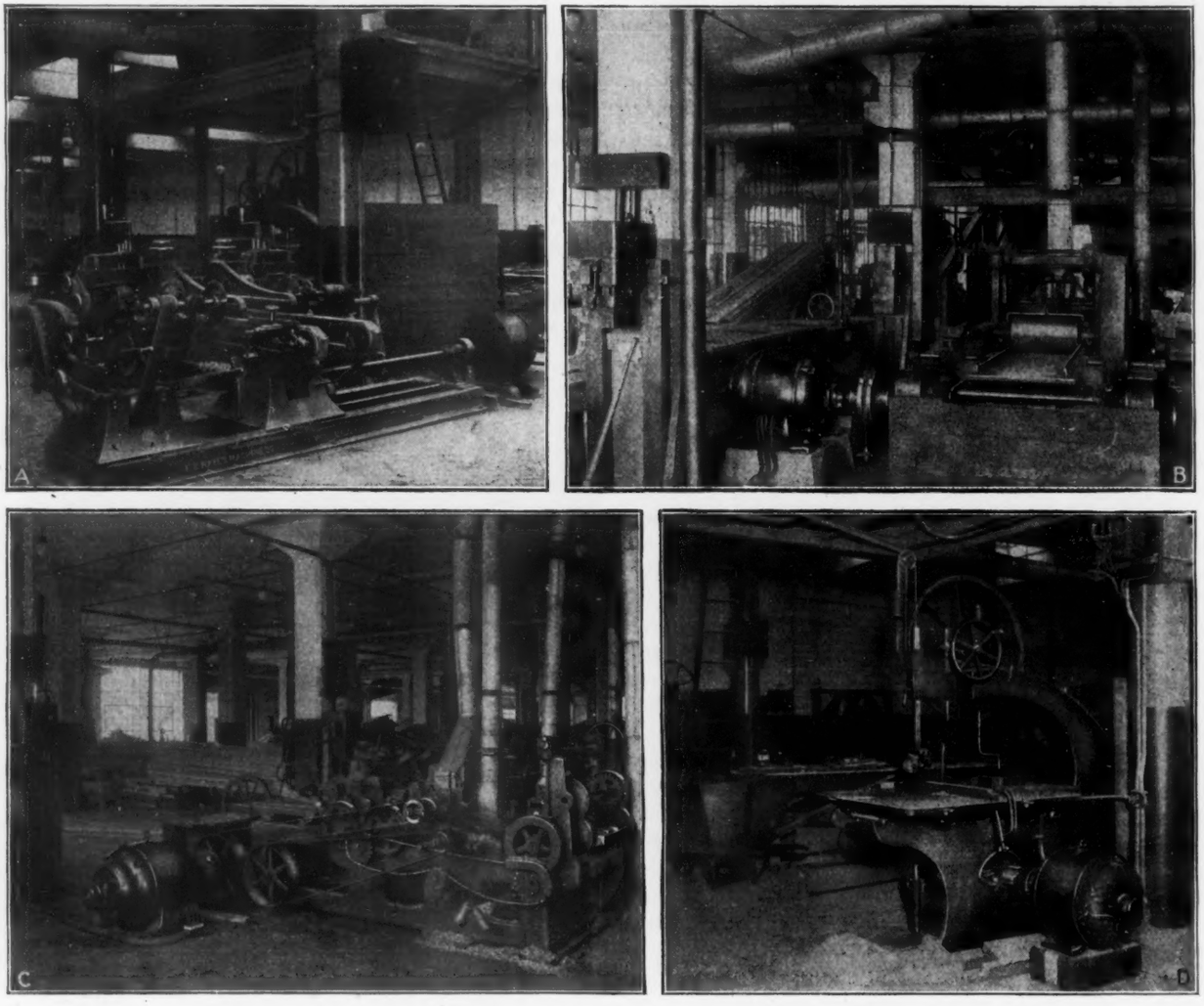


FIG. 2—VARIOUS APPLICATIONS OF MOTOR DRIVE TO WOODWORKING MACHINERY

A—Tenoning machine equipped with 15-hp., 750-r.p.m. direct-current motor and automatic push-button starter. B—Three-phase, 35-hp., 220-volt, 60-cycle, 850-r.p.m. induction motor driving double surfacer, in foreground; 40-hp. motor, in background, driving a timber band resaw. C—Matcher driven by a 30-hp. three-phase induction motor. D—Wood band saw driven by a 5-hp., 500-r.p.m. motor equipped with an automatic push-button controller for starting and stopping

with the disadvantages that there is no adjustment of the slip possible and that the starting current will usually be higher than when the slip-ring type is employed. The fact that the high slip is accomplished by internal resistance with the squirrel-cage type means, as stated above, a corresponding increase in the heat which

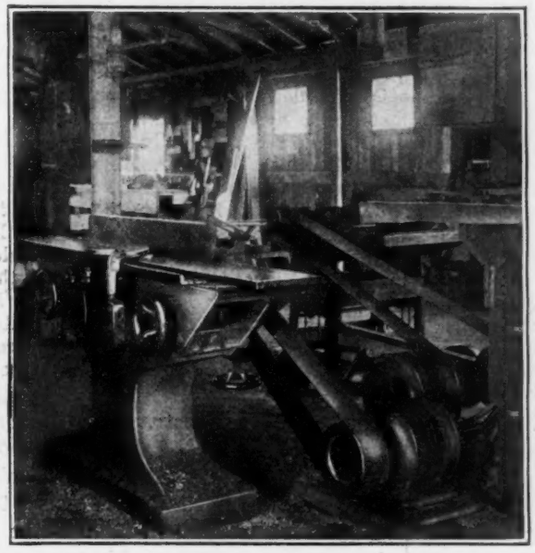


FIG. 3—PLANING-MILL INSTALLATION OF 3-HP., 720-R.P.M. INDUCTION MOTOR

must be radiated by the motor itself. Both types are used for band saws in timber sawing.[1]

PLANING-MILL OPERATIONS

About twenty classes of machines for individual motor applications are found in typical planing mills. Here, as in the timber-sawing applications, squirrel-cage motors are used for practically all planing-mill operations except those special cases like the band resaws, in the larger sizes, which possess large flywheel effect and where the slip-ring type is applicable for the reasons mentioned in connection with timber band saws.

Other cases have high friction typified, for example, by matchers, one of which is illustrated in Fig. 2C, and also wood planers. It is apparent, furthermore, that where the individual motors are large enough to constitute a fair proportion of the available generator capacity the lower starting currents of the slip-ring type form an important consideration.

Motor headstock equipments for woodworking lathes are commonly available both for three-phase alternating-current motors and for standard-voltage direct-current units.

EXAMPLES ILLUSTRATED

Specific cases of motor applications are shown in Figs. 2 to 4, which may be used as the basis of a further brief description of motor and control features as used in this industry. Fig. 2A is included to give an example of a tenoning machine (Hayes type) which is here driven by a 15-hp. direct-current motor. Automatic starting is employed. A special feature of this outfit is the use of a number of push-button stations for starting and stopping, only one of which is shown in the photograph in the foreground. Another station is placed directly opposite the one in the front, on the rear of the machine, and others are placed on the moving parts of the machine both in the front and in the rear. The complete control of his machine by the operator through such an arrangement is apparent. Power requirements of this machine and for some of the others shown in the subsequent views are given on the next page.

A wood band saw operated by a 5-hp., 500-r.p.m. Reliance motor fully equipped with an automatic starter and with start and stop push-button control is shown in Fig. 2D. The high mounting of the starting panel well overhead is illustrated by this view, and the large quantity of sawdust about the saw indicates the need for fairly frequent blowing out of the motor to free it from the accumulation of the dust. The necessity of dust-proof bearings is thus evident.

The use of small induction motors belted to planing-mill machines is shown in Fig. 3, these units being rated at 3 hp. and 720 r.p.m. In the foreground of Fig. 2B is shown a 35-hp., three-phase, 60-cycle, 220-volt, 850-r.p.m. motor directly connected to a Berlin double surfacer. This motor is automatically self-starting under heavy load. In the background a 40-hp., 1140-r.p.m. motor is shown belted to a 66-in. (1.67-m.) Mershon timber band resaw, equipped for feeding 18 ft. to 80 ft. (5.4 m. to 24.3 m.) per minute, and designed for 24-in. by 80-ft. (0.6-m. by 24.3-m.) timbers.[2] The control boxes are visible on the columns.

In Fig. 2C a Fay & Eagan matcher is shown with a directly coupled 30-hp., three-phase, 60-cycle, 220-volt, 850-r.p.m. Wagner motor, and in Fig. 4 a 10-in. by 20-in. (25.4-cm. by 50.8-cm.) Berlin double surfacer, at a different angle from the machine shown in Fig. 2B. The motors in Figs. 2C and 4 have the same ratings and speeds and are automatic, self-starting under heavy load in each case. In each of these views it is to be noted particularly that there is a distinct self-contained appearance in the machinery in contrast to that which would be possible with line shafts and belt drives.

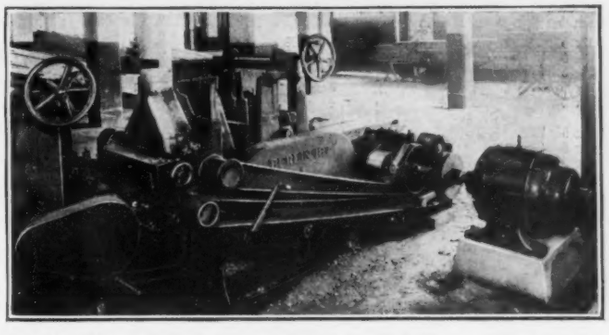


FIG. 4—DOUBLE SURFACER DRIVEN BY A 30-HP., THREE-PHASE INDUCTION MOTOR

The accompanying tables, I, II, III and IV, contain the average and maximum horsepower requirements of tenoning machines (Fig. 2A), band saws (Fig. 2D),

[1] See section on "Woodworking Machinery" by Chester W. Drake, "Standard Handbook for Electrical Engineers," fourth edition, p. 1201, which has also been referred to in connection with the next two paragraphs.

[2] To those interested in the specific types of equipment in these illustrations, it may be stated that Fig. 1 is due to the Electric Controller & Manufacturing Company, Figs. 2A and 2D to the Reliance Electric & Engineering Company, Fig. 3 to the Westinghouse Electric & Manufacturing Company, and Figs. 2B, 2C and 7 to the Wagner Electric Manufacturing Company.

surfacers (Figs. 2B and 4) and matchers and planers (Fig. 2C) respectively. These figures are based on the accumulated data of one of the larger motor manufacturers and are selected to accompany some of the machinery illustrated. As such, they are merely typical of a much larger amount of similar data on other machines in the industry which are now available. These four tables illustrate the form in which such other data has been tabulated.

TABLE I—TENONING MACHINES

Capacity, Inches	No. of Heads	No. of Copes	Feed-Feet per Min.	Horsepower Aver.	Max.	Remarks
4 x 24	1	2	9–18	10	20	
4½ x 54	4	0 or 2	10–13	10	...	Double-end
4½ x 54	8	0 or 2	10–13	15	...	Double-end
4½ x 78	4	0 or 2	10–13	10	...	.....
4½ x 78	8	0 or 2	10–13	15	...	.....
5½ x 14	1	2		3		.....
5½ x 15	2	2	Hand[1]	5	10	.....
5½ x 20	2	2	Hand	7½	15	.....
7 x 24	2	2	Hand	7½	15	.....

TABLE II—BAND SAWS

Diam. of Wheel, In.	Max. Saw Width, In.	Feed	Horsepower Aver.	Max.
48	5	Power	20	30
48	2[1]	Power	15	25
42	4	Power	10	20
42	1	Hand	5	7½
36	2	Hand	5	7½
32	1	Hand	3	5
26	1	Hand	3	5

TABLE III—SURFACERS

Capacity, Inches	No. of Heads	No. of Rolls	Power Feed Feet per Min.	Horsepower Aver.	Max.
15–30 x 6	2	6	100–200	40	60
20–30 x 6	1	4	15–40	10	15
27–36 x 6	1	4	25–75	15	25
16–24 x 7	1	4	18–32	5	10
24–36 x 7	1	4	16–50	7½	15
27–36 x 7	2	6	14–50	10	20
24–30 x 8	1	4	20–35	7½	15
24–30 x 8	1	4	30–50	15	25
24–30 x 8	1	4	20–35	7½	15
24–30 x 8	2	4	20–35	10	20
26–30 x 8	2	4	40–80	20	35
26–30 x 8	2	6	40–80	25	40
30 x 12	1	2	25–70	10	20
30 x 12	2	4	46–90	35	50

TABLE IV—MATCHERS AND PLANERS

Size, Inches	No. of Heads	No. of Rolls	Power Feed Feet per Min.	Horsepower Aver.	Max.
30 x 6	4	6	125	75	
21 x 6 / 15 x 6	4	8	40–80	50	75
9 x 6	4	8	40–80	50	60
24 x 6	4	4	25–50	20	30
15 x 6 / 30 x 6	4	6	50–90	50	75
15 x 8 / 30 x 8	4	6	40–80	30	50
9 x 8	4	6	40–80	20	30
24 x 6 / 30 x 6	2	4	30–50	15	25
24 x 6	1	4	30–40	10	20

SOME RESULTS OF A CHANGE-OVER

In conclusion, the following quotation is added from the opinion of a superintendent of a woodworking plant in which some of the reasons for changing over to individual motor drive in his plant are set forth. This quotation has been selected as containing in concrete form the substance of the inherent advantages of motor drive for woodworking establishments as viewed by those responsible for their operation.[2]

[2]Courtesy of Westinghouse Electric & Manufacturing Company.

While not more than 200 hp. is required to drive the machines by motors, the friction losses with line-shaft drive would be considerably more, so that a great waste of power is avoided. A large number of belts are eliminated with motor drive, greatly reducing belt maintenance. The speed of each machine is more easily maintained as belt slippage is practically eliminated. The company checks up speeds very carefully and will not tolerate a reduction in speed due to the overloading of too small a motor. If it is found that a motor on a particular machine is not of sufficient capacity, a larger one is put on. Thus maximum production is assured.

If one machine is shut down for repairs no others are affected. Individual motor drive permits arrangement of machines in almost any desired fashion in order to facilitate the passing of lumber from one workman to the other. Thus the sequence of operation is not broken and greater efficiency is obtained. It is almost impossible to accomplish this with line-shaft-driven machines arranged in parallel rows and requiring the lumber trucks to stand in the aisles. The fire hazard is greatly reduced owing to the fact that with motor drive there are no oily hangers. Lastly, individual motor drive makes the plant much cleaner, lighter, safer and more attractive in every way. The contrast between the motor and the engine-driven sections is very marked.

The advantages named in the abstract in the foregoing opinion have been rendered somewhat more definite by the motor manufacturers themselves. Their investigations into woodworking plants have shown the following points in favor of individual motor drive in certain cases: Increased production, 20 per cent; average maintained speed, 5 per cent higher than with line shaft and belt drive; saving in the 40 to 75 per cent power losses in line shafting, and insurance rates as low as 0.75 per cent from safety standpoint in electrically equipped buildings.

Bibliography.—"Standard Handbook for Electrical Engineers" and bulletins or data of Westinghouse Electric & Manufacturing Company, Electric Controller & Manufacturing Company, Reliance Electric & Engineering Company and Wagner Electric Manufacturing Company.

With but two small exceptions, no power developments and river improvements have been made by private capital upon navigable streams since 1912, and developments are prevented and held back aggregating over 2,000,000 hp. which would open over 1000 miles of additional inland waterways to navigation, through investment of private capital, and without taxation or appropriation of public moneys. The would-be conservationist has, in my judgment, been one of the greatest drawbacks to progressive water-power legislation we have in the whole country. Not one of them ever developed a water power or has had a particle of actual experience in this work. They simply advance fancied theories on the basis of state or government ownership and want all the benefits to accrue to the state, all the revenues; in fact, absolute control, even if built by private capital.—*Representative Bertrand H. Snell, New York, before the House of Representatives.*

New England Interconnection Plan Takes Shape

Representatives of War Industries Board, Massachusetts Commission and Fuel Administration Favor It—Committees Now Considering Financial and Operating Details—Propose Duplicate Line from Boston to Fall River

IN ORDINARY times the incentive for interconnecting electric service systems has been absent where each individual company has been able to meet its local requirements and at the same time maintain a sound financial condition. It has, therefore, been difficult to secure proper consideration of such propositions in a broad spirit of coöperation, simply because there has been no immediate need of any change from existing conditions.

Now, however, companies are at the parting of the ways in these matters. This country has undertaken a task which is to strain its resources to the utmost, not only at present, but for a material time in the future in certain lines of business. Facing power requirements which are with difficulty being met in certain areas, and with little prospect of the manufacturing companies meeting the demand with new production even within two or three years, every effort to increase the output of our plants should have the utmost consideration.

Again, the acuteness of the fuel situation for a long period in the future should cause attention to be directed to any methods of generation and distribution which will effect a reduction in fuel consumption.

Several companies in New England have concluded that both of these propositions can be met, in some measure, locally by a complete interconnection of the plants in eastern Massachusetts. As outlined in the June 8 issue of the ELECTRICAL WORLD, the execution of such a plan would save annually 70,000 tons of coal and would release about 50,000 kw. in generating capacity for other service.

This important matter is now in the hands of a finance committee of central-station interests headed by C. L. Edgar, president of the Edison Electric Illuminating Company of Boston, which is considering the best method of raising the necessary money for carrying out the program, at least in part, the project being regarded favorably by the public authorities and recognized as a war measure of vital economic interest. A sub-committee is considering the practical problems involved. Representatives of the War Industries Board, the Massachusetts Gas and Electric Light Commission and the conservation division of the United States Fuel Administration have been in conference with the representatives of the central stations, and the general consensus of opinion is that the plan should be carried out if it is possible to arrange the financial and operating details.

The greater part of the investigation thus far conducted by the central-station interests deals with southeastern Massachusetts, and various details of the project with reference to this section of the state are now available. Studies are being carried forward with respect to conditions on the north of Boston, both by the central stations represented and by the Bay State Street Railway, which operates a number of scattered steam plants in the territory.

The approximate location of generating stations and substations in the district southeast of Boston which are being considered with reference to interconnection is shown in the map (Fig. 1). This territory embraces the area from Boston to Newport, R. I., inclusive.

The principal plants operating in the territory, their generated outputs during 1917, unit coal consumption, total fuel burned, and estimated outputs and fuel consumption for 1918 are listed in Table I. With the exception of the Quincy Point station of the Bay State

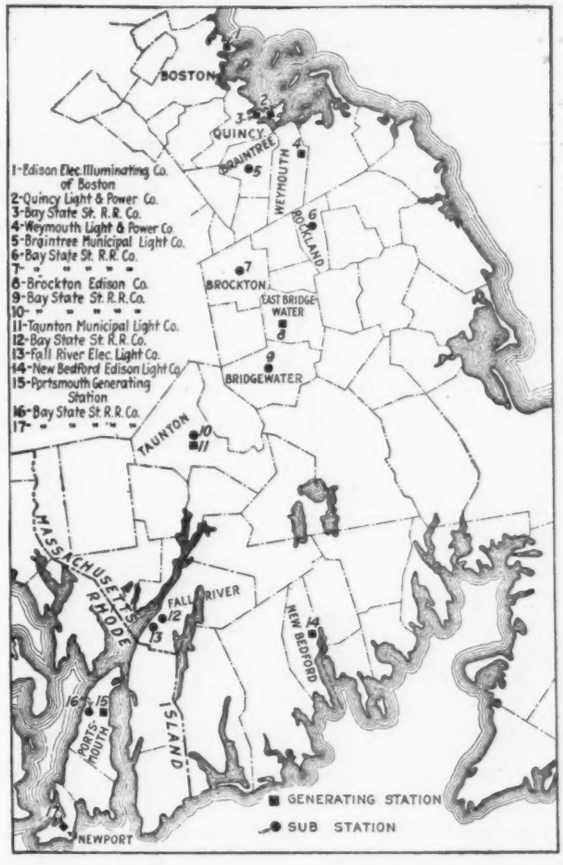


FIG. 1—EASTERN MASSACHUSETTS SHOWING APPROXIMATE LOCATION OF GENERATING PLANTS AND SUBSTATIONS TO BE INTERCONNECTED

Street Railway, all the plants listed are 60-cycle stations. It is estimated that by interconnection the fuel consumption in these plants would be reduced from an average of 2.38 lb. per kilowatt-hour to 1.93 lb., representing a saving of 38,586 tons for the southeastern district on the estimated 1918 consumption. At $8 per ton this saving would total $308,688.

Each of these plants is supplying its local area, with the exception of the Bay State Street Railway and the Edison Gas & Electric Light Company of New Bedford. The Bay State company operates a main generating station at Qunicy to supply such electric railway service as it provides in the communities between Boston and Fall River. A duplicate 25-cycle, 13,200-volt transmis-

sion system, constructed largely on a private right-of-way owned by that company, is employed to transmit energy from the Quincy station to the company's substations at Rockland, Brockton, Bridgewater, Taunton and Fall River. This transmission system, illustrated diagrammatically in Fig. 3, forms an important link in the proposed interconnected system.

The Quincy Electric Light & Power Company operates a 2300-volt generating station serving the city of Quincy. The heavy demands of the Fore River and Squantum shipyards for power have been met in this territory by the purchase of energy from the Bay State Street Railway Company's Quincy Point plant in the former case and by special submarine cable service from the Boston Edison system in the latter. The town of Braintree operates a 2300-volt plant of small rating and so far as is known has not been asked to supply any requirements in excess of its capacity. The Weymouth Light & Power Company operates a 2300-volt plant to serve a considerable area embracing several municipalities and is at present contemplating extensions to its plant in order to meet additional demands for service.

The Brockton Edison company operates a 13,200-volt plant serving Brockton and a number of adjacent towns. Its generating station at East Bridgewater is in close proximity to the Bay State company's transmission line between Quincy and Fall River, and in addition, its own transmission lines intersect and parallel those of the Bay State company at a number of points. This generating station, situated as it is about midway between Boston and Fall River, affords a most excellent means of dividing the load of the system into three principal areas with resulting high efficiency of transmission.

The city of Taunton operates a 2300-volt municipal plant to serve that community and at present is unable to meet the demands of its customers, let alone others who desire service. This city is the center of extensive manufacturing interests, many of them engaged on government work and where the demands for additional service are urgent. When interconnected with the proposed system additional capacity will be available at once for local use. The city's plant is within a short distance of the Bay State line and can easily be connected to it by a short overhead extension.

The Fall River Electric Light Company operates a 2300-4000-volt plant to serve Fall River and vicinity. In addition to its own station there is now under construction a heavy 66,000-volt connection with the system of the New England Power Company, via Pawtucket, R. I., where connections are made with the Blackstone Valley Gas & Electric Company's system and with the system of the Narragansett Electric Lighting Company of Providence, R. I. The Fall River plant, situated as it is at the southerly end of the Bay State transmission system, is most favorably placed to form part of the main interconnected system. Its principal substation is almost adjacent to that of the Bay State company, and it is suggested that it may be desirable to install 60-cycle equipment in the Fall River company's substation and operate the local street-railway service from that point in the future instead of transmitting 25-cycle energy from Quincy Point to Fall River for that purpose.

The New Bedford Gas & Edison Light Company operates a 2300-volt generating station supplying New Bedford and a number of adjacent communities. In addition to its local business, it has established a 22,000 volt transmission system and now supplies energy to the Buzzards Bay Electric Company, the New Bedford & Onset Street Railway, the Marion Gas Company and the Plymouth Electric Company, these smaller stations being shut down at present, though available for use when required. Energy generated in New Bedford is now being transmitted through the central Cape Cod district from Buzzards Bay to Chatham, a distance of about 90 miles (144.8 km.), the naval aviation base at Chatham being the most distant consumer of energy.

The Bay State Street Railway's station at Portsmouth, R. I., is a 600-volt direct-current plant supplying railway service exclusively within its own area. The company has considered replacing this plant by a new

TABLE I.—COMPARISON OF GENERATED OUTPUT AND COAL CONSUMPTION FOR YEARS 1917-1918

	Kw.-Hr. Generated 1917	Lb. Coal, Kw.-Hr.	Lb. Coal Used 1917	Estimated Kw.-Hr. to Be Generated 1918	Estimated Lb. Coal, Kw.-Hr.	Estimated Lb. Coal Required 1918
GROUP 1						
Edison Elec. Ill. Co. of Boston	265,000,000	1.97	522,050,000	305,000,000	1.93	588,650,000
Quincy Elec. Light & Power Co	3,000,000	4.2	12,600,000	3,500,000	4.2	14,700,000
Bay State St. Ry. Co., Quincy	45,500,000	2.8	127,000,000	55,000,000	2.5	137,500,000
Braintree Municipal Plant	650,000	6.4	4,160,000	650,000	6.4	4,160,000
Weymouth Light & Power Co	4,400,000	3.0	15,400,000	5,300,000	3.5	18,550,000
Edison Elec. Ill. Co., Brockton	29,000,000	2.17	62,930,000	35,000,000	2.0	70,000,000
Taunton Municipal Plant	7,500,000	3.7	27,750,000	8,500,000	3.5	29,750,000
Fall River Elec. Light Co	26,250,000	2.2	57,750,000	34,000,000	2.1	71,400,000
New Bedford Elec. Light Co	49,000,000	2.07	101,430,000	70,000,000	1.9	133,000,000
Plymouth Elec. Light Co	2,000,000	3.3	6,600,000	.....	....	.....
Buzzards Bay Elec. Light Co	1,200,000	5.1	6,120,000	.....	....	.....
Total	433,500,000	2.18	944,190,000	516,950,000	2.065	1,067,710,000
Estimated average coal consumption of combined plants when interconnected	.....	.....	.....	.....	1.92	992,544,000
Estimated saving in coal consumption with plants interconnected	.....	.....	.....	.....	0.145	75,166,000
Value of coal saved at $8 per ton (37,583 tons)	.....	.....	.....	.....	.....	$300,664
GROUP 2						
Bay State St. Ry. Co.—Portsmouth, R. I.	1,800,000	3.5	6,300,000	1,800,000	3.5	6,300,000
Bay State St. Ry Co.—Newport, R. I.	4,500,000	2.8	12,600,000	5,000,000	2.8	14,000,000
Total	6,300,000	3.0	18,900,000	6,800,000	3.0	20,300,000
Grand totals—Groups 1 and 2	439,800,000	2.38	963,090,000	523,750,000	2.077	1,000,010,000
Estimated average coal consumption of combined plants when interconnected	.....	.....	.....	.....	1.93	1,010,837,500
Estimated saving in coal consumption with plants interconnected	.....	.....	.....	.....	0.147	77,172,500 lb.
Value of coal saved at $8 per ton (38,586 tons)	.....	.....	.....	.....	.....	$308,688

substation supplied from a new 22,000-volt transmission line to be constructed from the Fall River substation of the trolley system to the Newport generating plant of the latter. At Newport the Bay State company operates a 2300-volt generating plant for the service of the local trolley lines and retail users of electrical energy, including the naval torpedo station and training station.

PLAN OF INTERCONNECTING PLANTS

The scheme of interconnecting these plants which seems most practicable involves the establishment of a duplicate 60-cycle, 13,200-volt transmission system from Boston to Fall River, with suitable connections to the various plants en route at convenient points. The details of the proposed system, including all lines, switching arrangements, apparatus and metering arrangements, are clearly set forth in Fig. 2.

It may seem at first that this voltage is too low for the loads and distances involved, but a study of the actual loads to be transmitted from each center of distribution, coupled with the large capacity of the conductors in the existing line, indicates that the present operating voltage will be both economical and satisfactory for a considerable period in the future, even though heavier loads were involved than those at present under consideration. Further, by continuing to operate this line at the present pressure, certain complications due to limitations in the operating voltage over certain portions of the right-of-way will be avoided and no obstacles will be placed in the way of the proposed use of the line.

This transmission system will comprise suitable construction from the Boston Edison station at South Boston to the Bay State Street Railway station at Quincy, there connecting to the railway company's transmission line to Fall River. The proposed system will have an interchange capacity of at least 10,000 k.v.a. between all points on the main line, although under the operating conditions proposed the energy transmitted between any two points will not exceed 5000 kva. normally.

It is proposed to construct a transmission line from the New Bedford Gas & Edison Light Company's station underground at 22,000 volts and overhead at 66,000 volts to connect with the Bay State line a short distance south of Taunton. This line, in addition to the short extensions which will be required to connect to the Quincy, Braintree, Weymouth and Taunton stations,

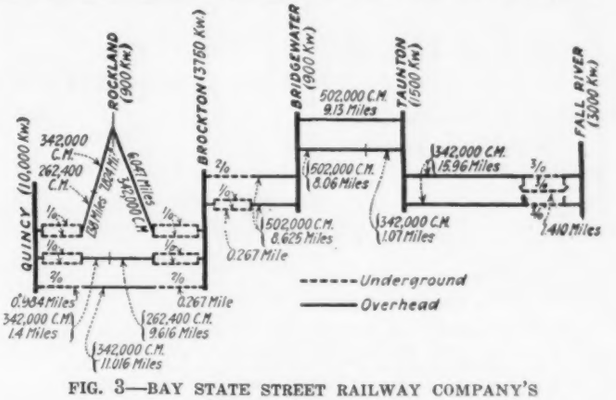


FIG. 3—BAY STATE STREET RAILWAY COMPANY'S TRANSMISSION SYSTEM

will complete the entire transmission system for the plants tabulated as Group 1.

It is further proposed to replace all 25-cycle rotary converters with 60-cycle units in the Rockland, Brockton, Bridgewater, Taunton and Fall River substations. These stations are admirably arranged to enable such a change to be made without interfering with their regular service, and when changed over will naturally derive their supply from the generating stations in the area in which they are located.

At the railway generating station in Quincy frequency changers will be installed to enable that plant to operate in conjunction with the rest of the system and at the same time supply 25-cycle service to the Fall River Company and to the railway substation at Quincy.

It is proposed to meter all energy delivered to or received by any company. Further details will be given in a later issue of the ELECTRICAL WORLD

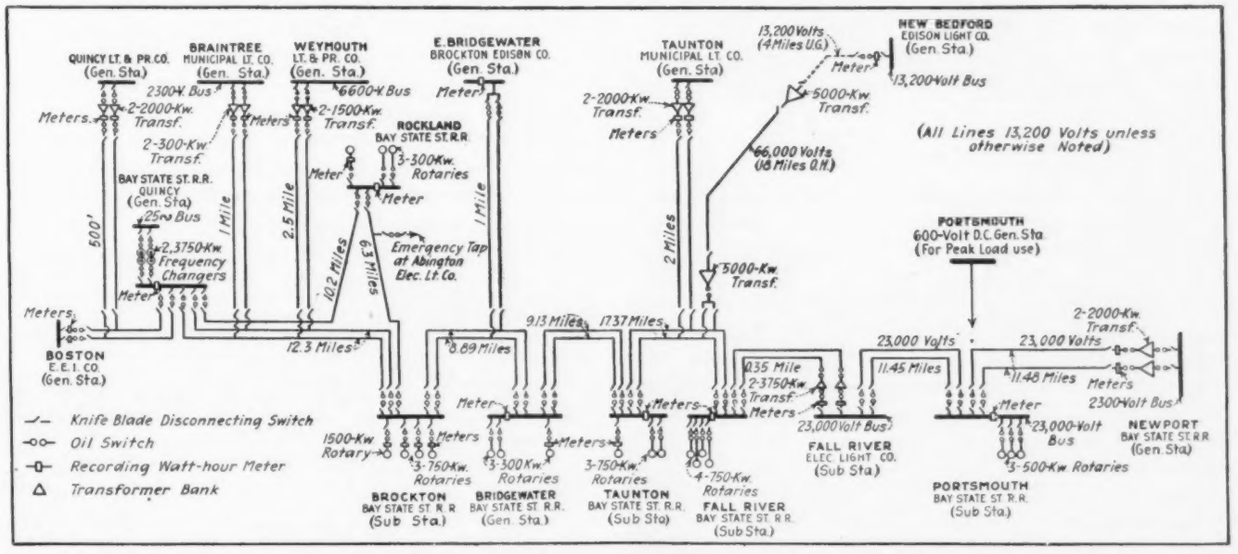

QUINCY LT. & PR. CO. (Gen. Sta.)
BRAINTREE MUNICIPAL LT. CO. (Gen. Sta.)
WEYMOUTH LT. & PR. CO. (Gen. Sta.)
E. BRIDGEWATER BROCKTON EDISON CO. (Gen. Sta.)
TAUNTON MUNICIPAL LT. CO. (Gen. Sta.)
NEW BEDFORD EDISON LIGHT CO. (Gen. Sta.)
BOSTON E.E.I. CO. (Gen. Sta.)
ROCKLAND BAY STATE ST.R.R.
BAY STATE ST.R.R. QUINCY (Gen. Sta.)
PORTSMOUTH 600-Volt D.C. Gen. Sta. (For Peak Load use)
FALL RIVER ELEC. LIGHT CO. (Sub Sta.)
BROCKTON BAY STATE ST. R.R. (Sub Sta.)
BRIDGEWATER BAY STATE ST. R.R. (Gen. Sta.)
TAUNTON BAY STATE ST. R.R. (Sub Sta.)
FALL RIVER BAY STATE ST. R.R. (Sub Sta.)
PORTSMOUTH BAY STATE ST. R.R. (Sub Sta.)
NEWPORT BAY STATE ST.R.R. (Gen. Sta.)
(All Lines 13,200 Volts unless otherwise Noted)
Knife Blade Disconnecting Switch
Oil Switch
Recording Watt-hour Meter
Transformer Bank

FIG. 2—GENERAL ARRANGEMENT OF TRANSMISSION LINES, TRANSFORMERS, MACHINES, SWITCHING AND METERING EQUIPMENT FOR PROPOSED INTERCONNECTION

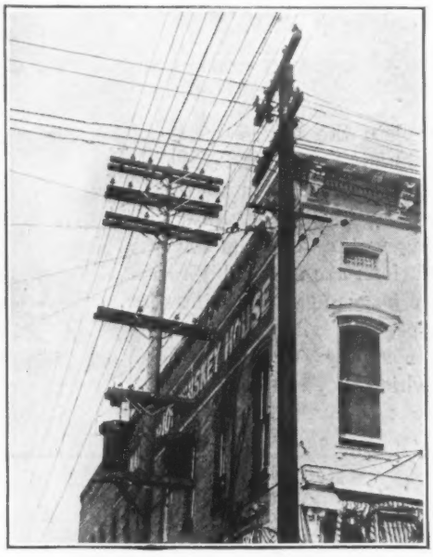
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MOVING TRANSFORMERS OFF THE MAIN STREET

How Fort Smith Company Is Attempting to Beautify the Main Thoroughfare of the City Without Resorting to Underground Construction

Customers along the main street of Fort Smith, Ark., were formerly served from electric-service lines on wooden poles. These poles carried primary and secondary lines, transformers and span-wire supports for



SHORT-SPAN SECONDARY LINES WERE MADE IN UNITS ON THE GROUND AND MOUNTED IN SECTIONS

trolley wire. Down the middle of the street, which is a very broad thoroughfare, was another line of round, steel poles with double mastarms, supporting the overhead circuits of the electric railway. This construction is all being changed so that the steel poles will be removed from the center of the street and the primary mains for the most part will be on side streets. The secondary lines and the span-wire trolley supports will all be carried on Bates expanded steel poles on each side of the street.

The accompanying illustration shows the method of getting the transformers, which constitute a large part of the unsightly equipment, off the main street. At street intersections where cedar pole leads cross the steel-pole leads, a short span has been erected between the adjacent steel poles and cedar poles. On the cedar pole which sets in the transverse thoroughfare, transformers and cutouts are mounted. The secondary wires of these transformers are carried from an arm which sets directly above the transformers to an angle-iron arm on the steel pole. From this short span taps are connected with the secondary wires above.

In erecting the short span, considerable time was saved by making up the unit sections of the span on the ground. Each unit section consists of an eye bolt and strain insulator at each end, together with the proper length of wire. After a unit had been made it was taken up the poles by a lineman and secured to the arms by screwing nuts on the ends of the eyebolts.

It is believed by the Fort Smith (Ark.) Light & Traction Company that this method of removing the major portion of the company's overhead lines and equipment from the main street will be nearly as effective in beautifying the thoroughfare as the adoption of underground construction.

MAXIMUM-DEMAND METER PRACTICE IN MINNEAPOLIS

Ideas That Are Found Useful by a Company Which Has Nearly 4000 Demand Indicators on Its Lines

The Minneapolis General Electric Company has more than 3000 Wright demand indicators, thirty Westinghouse type R. A. indicators and 387 General Electric type B-2 indicators on its lines. In addition all of its watt-hour meters have been equipped for use with demand indicators. The company buys the cams and springs and mounts them at its shop by use of a jeweler's staking tool. These attachments are made permanent, and special binding posts are put on the meter and the circuit is fused with a 1-amp. fuse. This fuse has proved very effective as a protective measure. The company does not advise the use of a standard cam wheel, since it has been found preferable to use a special cam contactor for each meter. While the factory sends out these indicators designed for overload capacity of 50 per cent, the Minneapolis company operates them only up to within 10 per cent to 15 per cent of the limit on the installations of certain customers where the load characteristics are well known. The reason for this is that it gives a higher degree of accuracy.

The first type "G" indicators received, gave considerable trouble due to vibration of the electromagnet. In this connection George W. Hewitt, foreman of the meter department, says that he found pivot points worn completely off during periods varying from ten to thirty days in service. These indicators were very noisy and could be heard 50 ft. (15.2 m.) away. This trouble has now been overcome by placing short-circuited shade coils over the tips of the magnet coils. On the new indicators the release springs are shortened from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (3.175 to 6.35 mm) as the setting is so loose that it causes shifting of the zero point due to the pen-point friction on the chart. The meter department has found that the protected-type clocks need to be cleaned every eighteen months while the indicators in which the clock is ex-

posed need overhauling every six months. It is the practice to bring Wright demand indicators to the shop for testing.

SOLVING WAR ECONOMY PROBLEMS IN NORTHWEST

Groups of Power Customers Are Served from One Transformer Bank for Increased Diversity—Lines Not Absolutely Essential Are Removed

In order to care for an increase of power load at minimum expense the Puget Sound Traction, Light & Power Company, Seattle, Wash., is taking advantage of the diversity of load between power customers on its 2200-volt lines. Several customers, formerly served by separate transformer banks, are now supplied from one set of transformers with a combined rating of 200 to 300 kw. Larger transformers with the same combined rating formerly required now serve an increased load. In the case of some large customers, service is given directly from the 13,800-volt feeders.

Rather extensive changes in the transmission system have resulted from the removal of lines which were not absolutely necessary, the equipment being used for new lines needed to serve industries essential to the war program. On the whole, about 20 miles (32 km.) of 55,000-volt line have been taken down and about 15 miles (24 km.) of new line have been erected with only a small amount of new material. At the same time the rating of the lines has been greatly increased.

It should be noted, also, that this company has found outdoor substations built upon four wooden poles the least expensive. The company is also changing from oil to coal-burning equipment, storing a reasonable amount of coal in open yards. One station is being equipped for the use of powdered coal, according to John Harrisberger, general superintendent of light and power, who has kindly supplied the foregoing information.

CONSERVING OIL IN BOILER ROOM

Places Difficult To Keep Lubricated Are Fitted With Bottle-Type Oilers

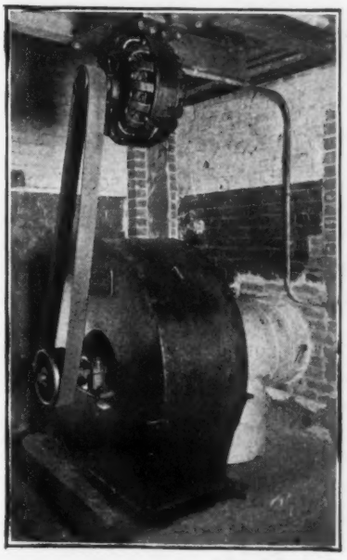
On the eccentrics which are part of chain-grate stoker drive, on stoker bearings and on economizer bearings, the Topeka (Kan.) Edison Company is using bottle oilers of the type manufactured by the Nathan Manufacturing Company and distributed through the Vacuum Oil Company. These devices are small bottles with tight-fitting plungers through which oil is obliged to leak to the bearings which it lubricates. This scheme of oiling is especially satisfactory for bearings which have been taking large amount of low-grade oil and which can be converted to use a smaller amount of high-grade oil.

At this plant, it was formerly the practice to fill the oil cups on the stoker eccentrics twice a day. Moreover, it was always difficult to get the firemen to attend to this work. With the bottle oilers it is only necessary to renew the supply of oil once every two weeks, although the bottles are inspected by the firemen on each shift. While a higher grade of oil is used in lubricating the bearings with the bottle oilers, only one-fourteenth as much oil is required as was used under the former system.

CABLES COOLED BY FAN

Temperature Was Substantially Reduced and the Carrying Capacity of the Line Thereby Increased —Fan Serves Nineteen Cables

Increasing loads on a cable duct line leaving the Dutch Point station of the Hartford (Conn.) Electric Light Company recently caused overheating, and to overcome this the motor-driven fan shown in the accompanying illustration was installed at the plant. In this line there are nineteen occupied ducts carrying cables operating at 22,000, 11,000, 4800 and 2400 volts, and telephone lines of the company in addition. The duct runs underground from the plant to a manhole about 250 ft. (76.2 m.) distant, and the temperatures of the unoccupied sections were obtained by inserting maximum and minimum thermometers in a mandrel and pulling them through after sufficient exposure to running conditions. Air is circulated through the duct by a 30-in. (76.1 cm.) fan belt-driven by a 5-hp. Westinghouse 220-volt induction motor mounted on the ceiling of the power-plant basement. An emergency connection is also provided so that the fan can be used to exhaust air or smoke from a transformer room below if necessary. By continuous operation of the fan the duct temperature was reduced from a maximum of 150 deg. Fahr. to 80 deg. Fahr. (71.1 to 26.7 deg. C.), thus enabling the cable line to carry an increased load for a given duct temperature and conserving copper.



MOTOR-DRIVEN FAN FOR VENTILATING CABLE DUCTS

RAISING THE VOLTAGE TO INCREASE LINE RATING

A Substantial Reduction in Line Current Is Realized by Changing from Delta to Star Connection of Transformers at Small Expense

As a matter of economy and to conserve the use of material the Louisville Gas & Electric Company has reconstructed the distribution lines throughout the city, changing the voltage from 2300 to 4000 volts by connecting the transformers in "Y." This arrangement greatly increases the line rating with very small investment. A similar plan is being worked out for the heavy power lines, the voltage of which will be raised from 6600 to 13,200. The latter change will release considerable transformer equipment since the largest turbine in the generating plant is wound for 13,200 volts.

These methods of meeting demands for more energy at small expense were called to the attention of the ELECTRICAL WORLD by A. S. Witmer, manager of the commercial department.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

A NEW SET OF RATES FOR SUMMER BUSINESS

Advance Charge Based on Number of Outlets with Additional Energy Rate Made by Canadian Company

In the matter of rates for summer business it is a known fact, says the report of the committee on rate research of the Canadian Electrical Association, that no meter rate can properly produce enough revenue on the average summer customer to pay the interest on the investment.

One of the member companies of the association, the report states, has instituted a new type of summer rate this year with a view to getting at least fixed charges out of these customers. The rate is $1 per outlet for the first ten outlets, plus 50 cents per outlet for the excess over ten, payable in advance, plus 4.5 cents per kilowatt-hour. It is found, generally speaking, that summer customers get away without paying their last bill and are very difficult to trace. In the case of the above rate a good deal of the charges are being collected in advance, and the company does not stand to lose so much revenue from "skips."

MORE ECONOMY IN BILL DELIVERY IS NECESSARY

Discussion of Methods Used by About Thirty Indiana Companies, Pointing Out Changes Made to Reduce Cost

BY O. M. BOOHER

Chairman Commercial Section Indiana Electric Light Association

Phases of operation, such as the distribution of statements, which during pre-war periods received only passing attention, are to-day demanding greater consideration. All unnecessary expense is being eliminated and all necessary expense is being reduced. Long-established customs are now giving ground to different and more economical methods. This is especially true in the distribution of bills. During the pre-war period a very large percentage of this work was handled by mail; to-day many companies ask their patrons to call at the office for their statements, and many others deliver their statements in person. Most of these changes of methods have taken place at least since the recent increase in postal rates.

The acid test of a plan is the way it works out in practice. From the standpoint of economy a certain arrangement may be fine and at the same time prove to be very impracticable from other angles. Considering the plan of bill delivering in person, there arise the complaints from customers who are displeased because of not receiving the statement regularly or receiving the wrong statement, etc. Another phase of this plan which must be considered is the general public opinion regarding the evasion of the war revenue which would be derived from the increase in postal rates.

Our company (the Indiana Railways & Light Companies) believes the saving effected by personal delivery more than offsets a few scattered criticisms and complaints which are heard from time to time from our customers. During the pre-war period our company was mailing its bills for the exact cost of $11 per 1000. This includes postal cards and printing. We are to-day delivering in person at a cost of $10.60 per 1000, including paper stock, printing and labor. Had we continued to send our statements out by mail the cost would be $21 per 1000. In other words, we are saving $10.40 per 1000, and for 8000 accounts a saving is realized of $83.20 per month, or approximately $1,000 per annum. The labor item figures 0.74 cent per statement delivered. Our statements are delivered by our metermen.

The writer is of the opinion that, considering the utility as a highly important war-time essential, the operators are performing a patriotic duty in trying to maintain financial equilibrium in order that the utility may continue to remain a valuable war asset. And if $1,000 per year can be saved by changing this or that operating plan, the change should be made, for such a change would be more in keeping with the general war program than the purchase of a few postage stamps, which net the government an infinitesimal profit.

Questionnaires were forwarded to forty-three leading member companies of the Indiana Electric Light Association, representing fifty-six different properties. Twenty-eight replies, representing thirty-nine properties, were received. The first question was, "Do you deliver by mail, in person, or are bills held at office?" There were thirty-four replies, divided as follows: By person, 15; by mail, 8; bills held at office, 11. One reported that bills were made out and left by readers. Question number two asked for the cost per statement delivered by person. There were twelve answers. The average was 0.89 cent each. Question number three asked, "Do you have many complaints from customers where bills are delivered in person?" All answered, "A few." In seven cases the meter readers did the delivering, in two cases office clerks, in two cases young boys, and in one case an office girl. It is of interest to note that where boys were used the cost per statement averaged only 0.49 cent each.

Because of the scarcity of men no doubt many companies which deliver the bills in person are considering the employment of women. So far as is known, this arrangement is not in use at this time to any extended degree. When the time comes there is no doubt that women will prove capable not only to deliver statements but to read and test meters and perform many other similar duties. The writer is of the opinion, however,

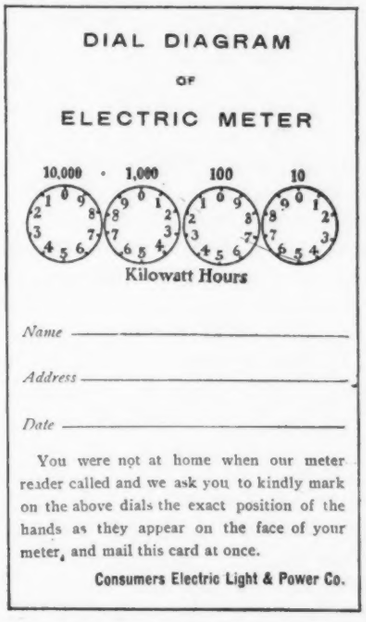
that women should not be used for these duties until absolute necessity demands it.

Another plan which might be considered is that of placing bill delivery in the hands of outside agents. In some cases agents may contract with all other local utilities for the performance of this duty and consequently be able to make a very attractive price. The writer feels, however, that the work should be done by men inside of the company in order that all irregularities may be properly looked after. From the replies received from the various companies regarding bill distribution it would appear that this question has not received proper consideration in some cases, or that there exists a wide difference of opinion.

DELAYED METER-READING POST CARDS SAVE MONEY

New Orleans Company Finds that in a Short Time 75 per Cent of Cards Left by Meter Readers Come Back Filled Out

In order to save the meter readers from the need of making return calls, the Consumers' Electric Light & Power Company of New Orleans, La., has devised a


DIAL DIAGRAM
OF
ELECTRIC METER
10,000
1,000
100
10
Kilowatt Hours
Name
Address
Date
You were not at home when our meter reader called and we ask you to kindly mark on the above dials the exact position of the hands as they appear on the face of your meter, and mail this card at once.
Consumers Electric Light & Power Co.

METER READING POST CARD MAILED BY CUSTOMER

delayed meter-reading post card. If when the meter reader calls he cannot get in, he leaves an addressed government post card, on the reverse side of which is a dial diagram of the meter on which the customer can mark the meter reading, and on which is also a place for the customer's name and address. The customer mails the card and is billed for the amount of energy shown to be used.

This system was put into effect in January of this year, and as early as May 75 per cent of the cards left were being returned to the company with readings indicated. In July General Manager W. J. Aicklen stated that through the use of post-card delayed-meter readings the company was effecting a saving of approximately $50 a month in meter readers' salaries.

HOW HIGHER RATES AFFECT CENTRAL-STATION REVENUE

Experience of New England Utility That Put an Increase of Four Mills per Kilowatt-Hour on Large Power Customers Only

Are increased rates producing the revenue desired on central-station systems? At this time it is difficult to answer this question categorically, and it is pertinent to look into specific cases. That of a large Massachusetts central station serving a community of 100,000 persons indicates that the increased yield is nominal so far, for the reason that the advance in rates as established to date applies only to the larger power customers. This advance amounts to 4 mills per kilowatt-hour, but it applies to so few of the customers that the total additional revenue which it is bringing the company probably will not reach $10,000 a year but at present runs nearer $5,000. On this system the policy has been maintained of refraining as long as possible from advancing rates, but there is a prospect that in the near future the increase will apply to all power customers and will then yield probably $30,000 a year increased revenue. The cost of putting the 4-mill increase into effect is trifling, and there are signs that public sentiment would not oppose this advance for the period of the war. In fact, it is probable that the company may in the near future be obliged to increase its lighting rates, and this is now being considered by the management. If this is done, the prospect is that a flat addition of 1-cent per kilowatt-hour will be added to the regular bills of the customers as a surcharge, denominated as such and presumably to apply for the period of the war only. It is believed that the public will accept such an increase if made.

EASY TO MAKE CHANGE TO DEMAND SCHEDULES NOW

High Cost of Equipment and Slow Deliveries on Apparatus Make Demand and Energy Schedule Easy to Explain

Companies which are contemplating a change in type of rate schedules from a straight energy rate to a demand and energy type of rate should have very little trouble in explaining the fairness of that system to consumers under present conditions. This is the opinion of Ohio utility managers who have had experience with making changes in types of rates both in normal times and under prevailing conditions. For instance, it is easy for a power user to see the justice of a demand and energy charge when he learns what prices he would have to pay for isolated-plant equipment to duplicate his service and when he further is made to realize that the interest charges on that equipment would be going on twenty-four hours a day while his use of it would be limited to twelve or sixteen hours a day.

One central-station man who recently changed his rates to the demand type in two small cities experienced no difficulty. He showed the justice of the change in every case by pointing out that the demand charge was made to take care of those items that the power user would have to stand if he owned his own generating equipment and operated it only part of the time.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Using Hogged Mill Refuse as Fuel.—The Portland Railway, Light & Power Company is storing a pile of hogged fuel which will contain the equivalent to 26,400 barrels of oil. The plant is adjacent to a sawmill where the fuel can readily be conveyed to the power station, which makes the use of this fuel especially profitable.—*Power*, July 16, 1918.

Ulco Hard Metal, a Substitute for Babbitt.—This metal, developed by Professors Frary and Temple of the University of Minnesota, contains 98 to 99 per cent lead and the remainder is barium and calcium. It was originally prepared for use in shrapnel shells, where it was of particular value owing to the scarcity of antimony. For replacing babbitt metal its principal advantage is in the saving of tin. Test data are given showing the comparative hardness, melting point, friction losses, etc., between ulco hard metal and babbitt metal.—*Engineering and Mining Journal*, July 20, 1918.

Getting a High Vacuum at the Turbine Exhaust.—HARTLEY LE H. SMITH.—The author calls especial attention to the fact that high vacuum in the condenser does not always give high vacuum in the exhaust nozzle of the turbine, which is the vital necessity. He discusses the design and arrangement of condensers, the effect of air in the condenser, etc.—*Electric Railway Journal*, July 20, 1918.

Large Hydroelectric Power Schemes.—C. FRED HOLMBOE.—In consideration of the possible coal shortage in the British Isles, the author points out the fact that there is a considerable opportunity for the development of hydroelectric energy. But it appears that the study of stream flow has not had sufficient consideration in England, with the prevailing idea that steam electric power generation is more economical there. On account of the increasing cost of coal, however, it is apparent that a greater investment per horsepower than formerly is now economical. The study of stream flow should, therefore, be carried on without further delay. The writer also discusses important considerations in hydroelectric design, such as the economical size of the reservoir, tunnels and pipe lines. Although hydraulic power cannot be developed as economically in Great Britain as in Norway and Sweden or the United States, the author cites the cases of two or three plants in Norway and Sweden to show what may be attained under most favorable circumstances. In the case of the Svalgfos power station, Norway, where the fall is 36.5 meters, the expenditure per horsepower is said to be £5. In the case of the Tysso plant, where the fall is 400 meters, the cost of development per horsepower was £5 10s. For the Trollhättan plant, in Sweden, the investment per horsepower is said to be less than £5. The author does not state any specific upper limit for the cost of economical development of water power in England per horsepower, but points out that this figure is undoubtedly increasing on account of the increasing cost of coal.—London *Electrician*, June 21, 1918.

Installations, Systems and Appliances

Development of Hydroelectric Power in New Zealand.—L. BIRKS.—A complete discussion is given of the considerations leading up to the development of the Lake Coleridge project. This development is owned by the state and energy sold in bulk at the load centers. The chief market for the energy is at Christchurch, where the electric railways are supplied as well as the light and power loads. Lake Coleridge, covering about 13 sq. miles (3360 hectares) form an excellent storage reservoir 1667 ft. (507 m.) above sea level and about 65 miles (104 km.) from Christchurch. The site offers opportunity for the utilization of 20,000 kw. continuous load, with a head immediately available of 480 ft. (146.3 m.). The plant at the present time has four Francis turbines of 2000 hp. each, directly connected to 1400-kw. alternators. The transmission line is of aluminum at 66,000 volts and was put in service in 1914. When the transmission system was first put in operation in 1914 the load increased very slowly until the customers realized the reliability of the service. A load then grew rapidly, consisting principally of railways, refrigerating plants, flour mills, tanneries, creameries, quarrying operations, hospitals, etc. The steam generating plant formerly used by the railway system now serves as a standby plant and will supply the load for a short time if the transmission system should be out of service. By means of economies effected by the operation of the Lake Coleridge plant prices for electrical energy have been reduced to less than one-half their former value. It is estimated that savings of coal of 15 to 25 tons per year per horsepower have resulted. By replacing kerosene and petrol with the electrical energy the saving in these fuels amounts to about £10,000 per year and shipping space is also saved. This cheap energy makes possible a supply of vital chemicals formerly purchased from Germany but at present unavailable in New Zealand. As soon as the present plant can be extended the development of electric furnace, electric welding processes, domestic heating and railway electrifications is confidently predicted. It is also a notable fact that at this time the load factor is between 50 and 60 per cent. The growth of load would undoubtedly continue rapidly if the plant could be extended, but just now steel for pipe lines for a new 3000-kw. generator cannot be obtained.—*New Zealand Journal of Science and Technology*, January, 1918.

Hog Island Ship Erection Equipment.—A description is given of the assembling plant of the American Inter-

national Shipbuilding Corporation at Hog Island. The use of 400 tower derricks for the fifty shipways is explained, this method being found more applicable than the use of traveling cranes. Alternating-current motors operate the hoisting engines. They are induction motors with the resistance control through slip rings. The main transformer substation receives energy from a high-voltage transmission line from Philadelphia and steps it down to 440 volts for underground distribution to the derrick towers.—*Engineering News-Record*, July 11, 1917.

Electric Butt Welding.—J. B. CLAPPER.—This method is largely used in the automobile and other metal industries, particularly in welding tubes, shafts, wheel rims, etc. Although the load drawn by one welding outfit fluctuates greatly during a small interval of time, the characteristics of a considerable number of such machines will overlap sufficiently to smooth out the demand. The outfit required for work of this sort consists of (1) a transformer, (2) means of connecting the pieces to be welded, (3) primary control switches, (4) means of forcing the pieces together. Either alternating or direct current serves this purpose. The secondary voltage may be from 2 volts to 6 volts and the current as high as 20,000 amp. Both the transformer and clamping blocks are commonly water-cooled. Tests show that this welding process gives very satisfactory results as it produces a joint nearly as strong as the normal section of metal. The author also calls attention to the so-called spot welding, replacing riveting of sheets, and the lap and seam welding for such work as putting a spout on a coffee pot. This method is applied to copper, brass and aluminum as well as to iron and steel with the same success.—*Journal Cleveland Engineering Society*, May, 1918.

Electrophysics and Magnetism

Luminescence of Uranyl Salts Under Cathode Ray Excitation.—FRANCES G. WICK and LOUISE S. MCDOWELL.—Irregularities in the fluorescence spectrum of uranyl salts under light excitation are discussed. Data are also presented concerning the persisting phosphorescence produced in these salts by cathode rays.—*Physical Review*, June, 1918.

Ionization Potentials for Electrons in Cadmium Vapor.—JOHN T. TATE *and* PAUL D. FOOT.—The authors state that the entire spectrum of cadmium is probably radiated at potenials above 8.92 volts as indicated by the appearance of a visible glow around the hot wire at 9.2 volts. Results obtained for the resonance and ionization potentials for electrons in mercury and cadmium vapors are regarded by them as a striking proof of the fundamental accuracy of conclusions based upon Bohr's theory of atomic structure.—*Bureau of Standards Bulletin*, June 24, 1918.

Wave Lengths of Tungsten X-Ray Spectrum.—The accurate determination of the number of spectrum lines and their wave lengths for tungsten was carried out. The Coolidge tube was utilized for obtaining X-Ray emission.—*Physical Review*, June, 1918.

Electrochemistry and Batteries

Electric Storage Batteries.—A consideration of their construction, theory of operation, care, installation and application. The article deals with the chloride accumulator, Exide battery, Willard plate, Gould plate and Edison alkaline battery.—*Power Plant Engineering;* Chicago, June 1, 1918.

Units, Measurements and Instruments

Water-Testing Apparatus.—An electrical instrument to indicate the presence of salt in boiler-feed water is described. An alarm is automatically given in case of considerable increase of salt.—London *Electrical Review*, June 28, 1918.

The Foot-Candle Meter.—C. F. SACKWITZ.—The article contains a description of a small portable self-contained device for measuring illumination which has been developed from a design originated by Dr. Clayton H. Sharp. The device is read directly in foot-candles.—*Transactions I. E. S.*, July 20, 1918.

Telegraphy, Telephony and Signals

Protective Devices for Cables.—A spiraled copper conductor may be wound on the cable insulation with a slight amount of insulation between itself and the lead sheath. If the cable is injured, this outer insulation will become weakened and the injury to the cable may be determined before damage occurs. By the use of suitable electrical devices this system may be equipped with an automatic alarm attachment.—London *Electrical Review*, June 28, 1918.

Miscellaneous

Elastic Coupling of Prime Movers and Generators—O. OHNESORGE.—This author describes the main features of an elastic coupling having the property of causing the forces to act on a comparatively large volume of the working fluid that provides the elasticity. A defect of most commercial couplings is due to the fact that there is not sufficient space within the coupling to bring enough working fluid into action. In the design shown the coupling consists of two parts connected by pistons working in cylinders that contain oil kept under pressure by connection with an air receiver to which the cylinders are joined by an oil-filled pipe passing through a hollow shaft. The elastic forces can be adjusted, even during running, by means of the pressure and volume of the air-receiver. *Science Abstracts, Section B*, May 31, 1918 (abstracted from *Zeits. Vereines Deutsch*, Feb. 16, 1918).

Gas and Electric Heating.—C. ORME BASTIAN.—It is well known that of the heat produced by gas only a small amount can be utilized on account of the escape of unused energy in the air draft. In electric heating devices, on the other hand, there is but small waste of energy. As an example of the efficiency of electrical heating the author cites the test of an electric furnace for tempering steel. The furnace was maintained at 900 deg. C. for one hour with 6000 heat units when heated electrically, but when gas was used to fire this furnace 75,000 heat units were required to maintain this temperature. Thus it may be seen that 30 lb. (13.6 kg.) of coal was required for the gas heating against about 6 lb. (2.7 kg.) for electrical operation. Fortunately, gas works have valuable by-products such as coke, but for straight heating purposes the electrical operation is evidently more efficient, says the author. Attention is called to the better atmosphere surrounding electrical heating devices, particularly in the home.—London *Times Engineering Supplement*, June, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

GOVERNMENT OPERATION OF ALL POWER PLANTS

Measure Framed to Stimulate Production of War Material Submitted by War Industries Board to Congress

A war emergency bill authorizing the President to acquire, construct and operate power plants of all kinds with a view to stimulating production of materials and commodities essential to the prosecution of the war, has been drafted by the War Industries Board and was submitted last week to Chairman Sims of the House interstate commerce committee.

Mr. Sims said the proposed legislation was designed to take advantage of steam power as well as water power during the war, and that, if introduced at all, it would be offered as an amendment to the pending administration water power bill now before the House.

The bill as first drafted by the board, would have been a substitute for the pending water power bill, which is a permanent power development measure, and it would have carried an appropriation of $200,000,000. As a result of the conferences between the board and Mr. Sims, however, the draft was revised and the appropriation eliminated, leaving that subject to later consideration.

In its present form the bill provides for compensation for property taken and also provides that the power to operate and maintain the plants taken over or constructed shall be exercised "only for such time as the President may deem necessary or advisable in the interest of the United States."

A NATIONAL UTILITIES RATE BOARD IS URGED

Initiative for Such a Body Comes from the National Association of Railway and Utility Commissioners at Washington

The establishment of a national public utilities administration to recommend rate increases for certain utilities as a war measure has been suggested to President Wilson by the National Association of Railway and Utility Commissioners representing practically all states commissions.

The association's proposals contained in a letter to the President were as follows:

Establishment of a national administrator, or board of three, with power of recommendation, advice or requests to the state and municipal authorities.

No disturbance of the rate and service powers of the state commissions or the contractual powers of the municipalities, except as the state or local authorities may subordinate these to the federal recommendations for the war time emergency, as we believe would uniformly be done.

Use of the state commissions by the federal administrator, or board, for all purposes of inquiry, investigation, ascertainment and report of facts and co-operation in recommendations where needed to the local authorities.

An increase in rates granted by local utilities commissions or by other local governing bodies at federal instance should be for the war only, it was suggested. The President was told that each application of utilities for rate increases must be considered separately, and that consequently it would be inadvisable for any federal authority to order a general rate advance.

SHORTAGE OF WATER POWER IN NORTHERN GEORGIA

Industrial Plants in North Georgia Have Difficulty in Obtaining Supply of Electricity—Severe Drought the Cause

A large number of industrial plants near Atlanta and in the northern section of Georgia have received notice from the Georgia Railway & Power Company that discontinuance of hydroelectric service has been necessary owing to extreme drought and the heavy demands upon power facilities by essential war industries. The communication sent out by the company reads as follows:

We regret very much to announce that, due to the extremely long drought and the consequent extremely low level of the rivers upon which our waterpower developments are located, and due to the tremendous demands made on our plants and reservoirs by customers working on war industries, it may be necessary for us to ask you to discontinue temporarily taking electric service, all or in part, from our lines, commencing with Aug. 1, 1918, and continuing temporarily until thereafter modified.

This letter, therefore, is to be taken as a preliminary notice to the effect that you may be requested to discontinue service beginning on the above-mentioned date unless we have such rains between now and that date as will, in our judgment, allow us to run water-power plants at nearer their normal capacity.

It is needless for us to say that we regret the necessity of serving this notice on you, but with the water level falling as rapidly as it is now in our reservoirs and with the same conditions existing in other water-power companies in this section, it may be impossible for us to carry the load longer than the date mentioned.

You will receive notice during next week, not later than July 29, 1918, if we do not get sufficient rain on our water sheds in the meantime to obviate the necessity.

The secondary customers of the company are still without power, although the company was enabled to carry all its primary load with some difficulty. Heavy rains on the lower levels during last week helped to swell the streams on which the plants of the Southern Power Company, Columbus Power Company, and the Central Power Company of Georgia are located. The Georgia Railway & Power Company was thus enabled to get some flood water from the plant of the Southern

Power Company and store it in its Mathis reservoir. The Dunlop and Bull Sluice plants also received enough water to operate.

The water of the Chattahoochee River after passing through the wheels at the Georgia Railway & Power Company's station was caught by the station of the Columbus Power Company farther down the river, and the latter company was thereby enabled to supply the former with some electricity over the tie lines.

There were light showers on the watersheds serving the Tallulah Falls station, but the flow in the main river at present is only about one-tenth normal. Up to Aug. 1 there was a decrease in the rainfall of about 25 per cent, or approximately 10 in. of water.

RELIEF FOR INDIANAPOLIS LIGHTING COMPANIES

Rate Increases Permitted by Commission, Which Also Urges a Pooling of Systems During the War

The Indiana Public Service Commission in an order entered late Tuesday granted war-time relief to the Indianapolis Light & Heat Company and the Merchants Heat & Light Company by a revision of rates affecting larger domestic consumers and all users of electricity for power purposes. The principal change in the domestic lighting schedule order by the commission is an increase of what is known as the secondary rate in the schedules used by the majority of domestic consumers from a rate of 5 cents a kilowatt-hour to a 6-cent rate.

The principal changes in the power schedules include the addition of 7 mills surcharge for each kilowatt-hour of energy consumed and the establishment of a monthly minimum bill on power rates of 1.65 cents a kilowatt-hour of energy consumed. A surcharge of 5 mills a kilowatt-hour on municipal lighting energy also is provided and this provision and that increasing the secondary rate for domestic consumers becomes effective on Aug. 10 and will continue in effect for the duration of the war or until Dec. 31, 1920. The increase to 7 mills a kilowatt-hour surcharge on power rates is 2 mills a kilowatt-hour above the 5-mill surcharge granted the companies by the commission last year. This increase is effective for the same period as the lighting-rate increases.

The establishment of a minimum monthly rate for power is to become effective on Aug. 10 and be permanent in nature. The order allows the companies 50 per cent surcharge on all bills for steam and hot-water heating, and this represents 100 per cent increase in the surcharge above the relief granted last year, when the commission allowed a 25 per cent increase on all such bills. This increase becomes effective at the beginning of the heating season and will continue during the war or until the conclusion of the heating season of 1920-1921.

The commission's order also urges a pooling of the plants for the economies and other advantages to be gained during the continuation of war conditions. In explaining its increase of the secondary rate for domestic consumers the order sets out that the commission believes this will encourage thrift and economies by the class of domestic consumers which uses relatively more electricity than the class of smallest consumers. The primary rate of 7 cents a kilowatt-hour for domestic consumption covers approximately the first 15 kw.-hr. consumed in any one month, and after that amount of energy has been consumed the secondary rate applies. It is this secondary rate which has been increased by the commission.

It is understood that the commission estimates that the relief granted the companies this year will be greater than that granted them during last year; but it likewise is estimated by the commission that the revenues under the new rates will not be great enough to admit of any dividends on the common stock except a possible very small return to the stockholders of the Indianapolis Light & Heat Company.

SYNDICATE BUYS $10,000,000 DUQUESNE COMPANY NOTES

Issue Is Secured by 5 Per Cent Mortgage Bonds on All Property Owned and by First Lien on All Leaseholds

Announcement was made on Tuesday that a syndicate headed by Harris, Forbes & Company, the First National Bank and Ladenburg, Thalman & Company has purchased an issue of $10,000,000 three-year secured notes of the Duquesne Light Company of Pittsburgh. The notes in addition to being a first obligation of the company are secured by the pledge of all of an outstanding issue of $15,000,000, 5 per cent mortgage bonds. These bonds are secured by a first mortgage of all of the property owned in fee by the company and by a first lien upon its leasehold interests, together with bonds and stocks of its subsidiaries. The company controls through long-term lease or stock ownership properties conducting the entire central station, electric light and power business in the city of Pittsburgh and throughout the major portion of Alleghany and Beaver Counties, Pa.

VALUATION OF WASHINGTON WATER POWER COMPANY

Engineers of Commission and of the Utility Present Figures Differing Only Slightly in Amount So no Order Is Issued

On Aug. 1 following the hearing on this apportionment of the Washington Water Power Company property Chairman E. F. Blaine of the Public Service Commission of Washington announced that no order would be issued in the matter as the engineers of the company and the commission were so close on data that no order would be necessary. He said copies of both engineers' data would be sent to all committees to be used as a basis for rate making.

Testimony was taken on July 31 in Spokane, Wash., by the State Public Service Commission on the apportionment of the valuation of the Washington Water Power Company light and power system among the several communities served by it in eastern Washington.

Engineer McCurrach appeared for the State, and J. S. Simpson, former accountant for the Public Service Commission, for the Washington Water Power Company.

Their division of value differed slightly in some of the details but agreed on the larger totals. Simpson's total for the city of Spokane was $100,000 less than that of Engineer McCurrach.

The figures of the two experts were practically accepted by the representatives of the municipalities present, including the city of Spokane.

The following figures are from the report of Engineer McCurrach as to the light and power valuation in Washington: Cost of reproduction Dec. 31, 1917, $14,854,674.

Valuation as fixed by Public Service Commission, $16,700,000.

VALUATION APPORTIONED BY DISTRICTS

District	Maximum Demands Kilowatts	
Spokane-Hillyard	24,135	$10,483,091
Medical Lake-Cheney	1,948	679,935
Spokane suburban	2,790	758,404
Palouse	1,632	1,114,709
Big Bend	3,260	1,471,459
Utilities	9,140	2,192,402
Totals	42,905	$16,700,000

CHANGES MADE IN THE NATIONAL ELECTRICAL CODE

Suspension of the Rule Calling for Marking of Wires to Facilitate Polarity Identification Made in Interest of Economy

The executive committee of the National Fire Protection Association, upon the recommendation of the electrical committee of that organization, has voted to suspend indefinitely the enforcement of Rule 26-a of the National Electrical Code, edition of 1918, in so far as this rule requires the marking of wires and cables by manufacturers to facilitate the identification of the polarity of conductors.

This rule, which is new in the 1918 code, was adopted last fall as a part of the report of the sub-committee on grounding and as printed in the code calls for enforcement after Jan. 1, 1919. It reads as follows:

> The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity.
>
> When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Nos. 15 and 15A.

The purpose of the rule was to facilitate the identification of the neutral or grounded wire of a circuit in order that the proper grounding might be secured in all cases with less liability to mistakes, and as a part of the general tendency noticeable in the development of electric practice at the present time to extend the grounding of circuits and devote more attention to this and similar requirements, especially from the viewpoint of safety against accident to persons.

The recommendation for suspension of this rule came from Underwriters' Laboratories' Industry Conference on Rubber-Covered Wires after a careful investigation of the present situation had been made among wire manufacturers and others. This investigation developed the opinion that the present time under war conditions was unfavorable for the change involved, in view of the considerable increase in equipment at wire factories already pressed to the limit to provide the products necessary for government and other uses and the probable added expenses which would result in carrying stocks, in transportation and in distribution of wires and cables.

The idea has been suggested that inspection departments, contractors and others desiring to secure the result aimed at in the rule in question might arrange for a marking of conductors and terminals at outlets as they are installed by means of painting or other distinguishing marking. It would appear that if this were done carefully and systematically most if not all of the desirable results aimed at could be secured.

CENTRAL STATION—MUNICIPAL PLANT INTERCONNECTION

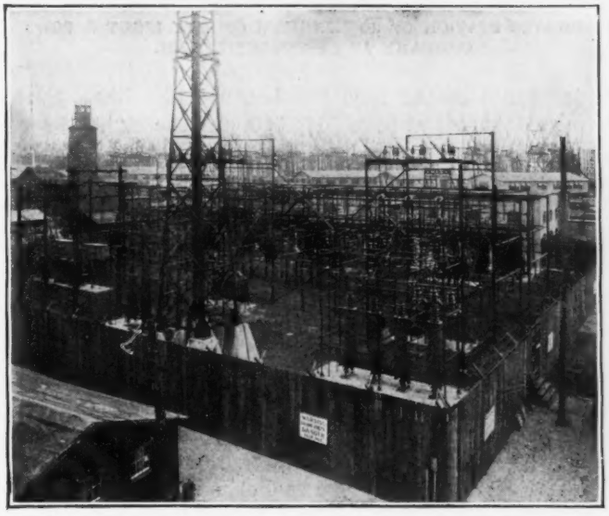
To Save Coal Commonwealth Edison Company Will Purchase Waste Power from Sanitary District —Provision for Present Is 6000 Kw.

For the purpose of saving coal the Commonwealth Edison Company of Chicago has entered into a contract with the Sanitary District to purchase energy which can be produced from water power which is now wasted. For all water power energy which the Sanitary District can provide, the Commonwealth Edison Company agrees to pay the equivalent of the net coal saved. The amount of coal that can be saved depends upon the units which the Commonwealth Edison Company must use to carry its load at the times when the Sanitary District has surplus power available. The new units are more efficient than older ones and hence require less coal to produce a kilowatt-hour. On Sundays the entire load can be carried on the more efficient units and on week days the less efficient units must also be operated. With these facts in mind and with a knowledge of the coal consumption of different combinations of units an estimate was prepared of the net coal that could be saved on Sundays and holidays and of the net coal that could be saved on week days. It was agreed between parties to the contract that this estimate was correct and figures which came out of the estimate were made a part of the contract. The payments are to be made on a straight kilowatt-hour basis. The price per kilowatt-hour is expressed as a constant (which came out of the estimate) times the price of coal. The coal price is taken as the average price over a period of four months. A different constant is used for Sundays than is used for week days. The constant used is 0.0009 for Sundays and holidays and is 0.00125 for week days.

The contract also stipulates that this constant shall be changed when the Commonwealth Edison Company puts another new unit into service and shall change again when the company builds its new Calumet generating station, if the war lasts that long. The period which the contract covers extends to the termination of the war.

Physical connection between the two systems is a simple matter as both operate in the city at 12,000 volts, 60 cycles. A connection capable of transmitting 6000 kw. will be effected at the Troy street substation of the Commonwealth Edison Company.

Largest Shipyard in the World Is Electrically Operated



PORTION OF HOG ISLAND TOGETHER WITH VIEWS OF OUTDOOR SUBSTATION AND SWITCHBOARD

This shipbuilding plant which is supplied with electricity by the Philadelphia Electric Company, has 475 electric hoists totaling 17,000 hp., 2400 hp. in shop motors, 42,000 kva. in transformers, 110,000 incandescent lamps and nineteen motor-driven compressors

CENTRAL-STATION ENERGY ECONOMICAL FOR RAILWAYS

Investigation by Commission Shows That Purchased Power Is Least Expensive Method of Getting Energy Supply for Electric Railways

In the recently heard fare case of the Massachusetts Northeastern Street Railway an investigation of the cost of power on the road was made by the Massachusetts Public Service Commission. During the hearings some criticism was advanced against the company on account of the fact that in 1917 its cost of power was $223,593, or about $55,000 more than in the fiscal year 1916. Energy is purchased from the central station of the Rockingham County Light & Power Company, located on tidewater at Portsmouth, N. H. J. W. Lester, chief accountant of the commission, made a thorough study of the cost of electricity as produced at Portsmouth and delivered to the railway company, comparing the current rates with the estimated cost of generating energy in a new plant to be owned and operated by the railway, and also discussing electrical production costs in other Massachusetts stations.

The conclusion reached was that the purchase of central-station energy by the road was cheaper by about $45,466 per year than an attempt to generate in a plant of the railway.

The base price of energy to the railway company under the central-station contract is 1.4 cents per kilowatt-hour, electricity being delivered at the substations as three-phase, 13,200-volt energy. By the operation of

a coal clause in the contract the average price paid for energy in 1917 was 1.77 cents, for alternating-current energy at the substations, comprising 11,687,908 kw.-hr. There were 10,239,232 kw.-hr. of direct-current energy delivered by the railway itself to its 600-volt feeder and trolley system. This brought the actual cost per kilowatt-hour of direct-current energy to 2.18 cents, and allowing 15 per cent for fixed charges, the total was 2.47 cents.

The Rockingham County company's station at Portsmouth generated energy in 1917 at 2.52 lb. of coal per kilowatt-hour, compared with 2.82 lb. on the Bay State Street Railway and 2.15 lb. on the Boston Elevated Railway. An interesting comparison of the cost of production at Portsmouth in 1913, the year before the war began, and in 1917, is printed herewith. It is significant

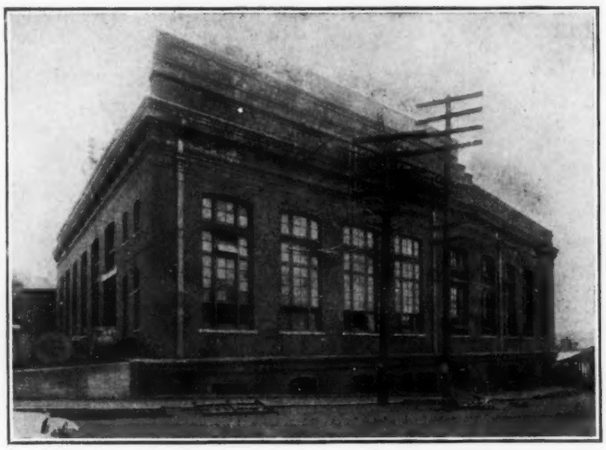
PRE-WAR AND PRESENT PRODUCTION COSTS, PORTSMOUTH (N. H.) PLANT

	1913	1917
Wages	$25,035	$28,704
Fuel	77,005	191,095
Water	6,156	3,377
Miscellaneous supplies	5,117	4,636
Steam-plant maintenance	13,197	17,997
Electric-plant maintenance	1,973	978
Buildings and fixtures	1,115	3,873
Total	$129,512	$250,663
Kilowatt-hours generated	15,372,269	20,102,800
Net production cost per kw.-hr., mills	8.43	12.47
Pounds coal per kw.-hr.	3.19	2.52
Average cost coal in crusher per ton	$3.65	$7.51
Coal cost per kw.-hr. (mills)	5	9.5

that the efficiency of this plant has been increased as regards the amount of coal consumed per unit of output since the outbreak of the war, but that the cost of fuel has increased more than 100 per cent and that it has been impossible to generate energy at as low a cost as in 1913. This plant is now undergoing reconstruction and enlargement by the Harry M. Hope Engineering Company of Boston, and a carefully planned betterment program is yielding results, as evidenced by the striking reduction in coal consumption per kilowatt-hour as tabulated in Mr. Lester's report. In fact, in 1914 this fuel consumption attained a maximum of 3.40 lb. for the year, but the trend has since been downward.

In 1916 an estimate was made that a plant consisting of two 5000-kva. turbines, four 500-hp. water-tube boilers, a 12-ft. by 200-ft. (3.6-m. by 60-m.) self-supporting steel stack, a 200-ton coal bunker and accessories could be built on tidewater for the Massachusetts Northeastern company at a total cost of $552,000, or $55.20 per kva. This estimate was recently revised, and, covering the same items as in 1916, it was found that the installation could not be made for less than $1,106,000, or just about double the cost of two years ago, $110.60 per kva. being the figure for May, 1918. It is estimated by Mr. Lester that in case this new power plant were in operation at this time and the turbine equipment were producing energy on 2.15 lb. of coal per kilowatt-hour, the plant would consume 11,229 tons of coal. Thus, if purchased at the average price of $8.63 per ton, which is less than the price of coal delivered to-day at Portsmouth, the cost would be $96,906, to which would be added the cost of substation labor and expense, about $16,600, and also the labor and other expenses of generating energy at the main power plant.

In the case of the Boston Elevated Railway the labor and miscellaneous station costs of production are 1.95 mills per kilowatt-hour, which Mr. Lester states is lower than that of any of the steam generating plants of the state. Using this conservative figure, the cost to the Massachusetts Northeastern company would be increased by $22,815, and an allowance of 12 per cent for interest, taxes, insurance and depreciation would add $132,720, making the total cost of delivering energy to the railway lines at the substations $269,060, exclusive of the charges on the station site and the interest and



TIDEWATER STATION OF ROCKINGHAM COUNTY LIGHT & POWER COMPANY AT PORTSMOUTH, N. H.

maintenance of the requisite transmission line. Such a line would cost at least $175,000, and the right-of-way would have to be added. The commission's investigation therefore showed an annual net saving of at least $45,466 by continuing to purchase central-station energy.

Central-Station Energy Cheaper for Springfield Railway

In April, 1917, a contract was made between the Springfield Street Railway and the Turners Falls Power & Electric Company whereby the railway company is to pay the power company at the rate of 11 mills per kilowatt-hour for energy taken at most points on the trolley system. There is no coal clause in this contract, and the energy sold is in the form of direct current at 600 volts. The contract did not become operative until late in the year, and in 1917 the railway company generated 71 per cent of the energy used. This was produced in a relatively inefficient steam plant on a coal consumption of 4.45 lb. per kilowatt-hour, and the average cost of power for the railway for the year 1917, including fixed charges, was 2.19 cents per kilowatt-hour. This year the economical service of the Turners Falls company will result in a large saving in coal for the Springfield transportation system, and such energy as is produced in the steam plants of the Turners Falls company will be generated in the new Hampden steam-turbine plant of that organization now approaching completion at Chicopee Junction, and at a far better economy than was possible in the old railway plant at Margaret Street, Springfield. The latter, in fact, has recently been placed on the second-hand machinery market.

The Worcester Consolidated Street Railway, which generates a portion of its power and purchases the rest,

is fortunate in having a very favorable contract with the New England Power Company and is also fortunate in owning a generating station at Millbury, Mass., equipped with efficient turbines. These units develop energy on 2.11 lb. of coal per kilowatt-hour, and the average cost of power per kilowatt-hour for 1917 on this road, including both generated and purchased energy, was 8.8 mills. The cost, including interest, taxes and depreciation on plant and equipment, was 2.01 cents.

The Middlesex & Boston Street Railway, serving the suburban territory of the west of Boston, purchases its energy from the Edison Electric Illuminating Company of Boston upon terms which were criticised by the Public Service Commission in the 1914 fare case. At that time the average cost of power was about 1.75 cents per kilowatt-hour to the railway. The average cost of power to the Middlesex & Boston company is now about 2.17 cents. In a recent decision affecting fares on this road the commission acknowledges the economic advantage of central-station service, pointing out that the recent extraordinary advance in the price of coal, brought about by the war, has made the contract with the Edison company advantageous for the time being and has protected the railway against a heavy increase in operating cost on this account from which other trolley roads have suffered severely.

BANKERS PLAN TO AID PUBLIC UTILITY FINANCING

Amendment of Law Govering Loans by War Finance Corporation Suggested After Adverse Ruling of Attorney General

Right on top of the news from Washington that the plan for a $100,000,000 corporation to act as an intermediary between borrowing corporations and the War Finance Corporation had been knocked in the head by a ruling of the Attorney General, bankers interested in public utilities set to work to devise another plan.

The original plan instigated by the New York bankers and strongly supported by Chicago bankers was declared to be faulty. The Attorney General, deciding that Sec. 10 of the war finance act limiting loans to any one corporation to 10 per cent of the War Finance Corporation's capital applied to the proposed intermediary corporation. In consequence, the utmost amount that such a corporation could receive from the War Finance Corporation is $50,000,000.

The formation of a $60,000,000 or $70,000,000 intermediary corporation to aid the financing of public utilities was suggested at a conference of bankers in New York on Tuesday of this week. The opinion among the bankers generally was that the law as interpreted seems unworkable and that either the act will have to be amended or the interpretation of the Attorney General changed. If the War Finance Corporation were authorized to function more as an underwriting corporation than a money lender, many bankers believe its mission in aiding essential industries would be improved.

The bankers' efforts to devise instrumentalities for supplying public utilities with needed capital will continue to be co-ordinated through a special committee of which James W. Wallace, president of the Central Union Trust Company of New York is chairman.

INCREASE IN WAGES FOR ELECTRICAL WORKERS

Linemen and Splicers on the Pacific Coast and Electricians in Steel Mills Win Wage Decision

In a decision on the Bethlehem Steel Company's dispute involving workers on government contracts, the National War Board on Aug. 4 ordered the revision or complete elimination of the bonus system now in operation at the plant, a revision of piece-work rates and the establishment of a designated guaranteed minimum hourly wage rate. The workers are moreover granted the right to organize and bargain collectively.

The award applies the basic eight-hour day with payment of time and a half for all overtime, double time on Sundays and holidays, and orders the company to pay men and women alike when performing the same work. The case came before the War Labor Board following a series of strikes of machinists and electrical workers and after various government agencies bent on mediation had exhausted their efforts.

Specific wage increases are granted to 440 electrical workers who demanded increases to 67½ cents an hour for electricians and at least 40 cents an hour for helpers. The board awarded 67½ cents an hour for first-class electricians, 62½ cents an hour for second-class electricians and 40 cents an hour for helpers.

By referendum vote in about twenty locals of the Electrical Workers' Union, it was decided to accept the offer of 80 cents a day increase in the wages of electrical workers and cable splicers offered by the Pacific Gas & Electric Company of San Francisco. Electrical workers getting $5 a day are to get $5.80 and cable splicers getting $6 a day are to get $6.80. This increase, which will affect about 800 men, has also been granted employees by the Great Western Power Company, and the Western States Gas & Electric Company.

MEETING OF INDIANA ELECTRIC LIGHT ASSOCIATION

The Coal Situation Was the Chief Topic for Discussion and All Year Daylight Saving Is Advocated

Coal conservation in its many phases was almost the sole topic of discussion at the one-day meeting of Indiana Electric Light Association at Indianapolis on Wednesday. Mr. Vanblarcon, assistant to Charles E. Stuart, chief of power and light division, United States Fuel Administration, speaking on war conservation of light and power forecast changes which light and power men must soon expect. He intimated that lamp policies will have to be changed to encourage the use of smaller lamps, and to insure the elimination of carbon and "gem" lamps, discarding of free lamp renewals will be advocated. Further action looking to coal economy through the shutting down of inefficient isolated plants may be expected and further interconnection of utilities will be advocated. Even ice plant operations will be regulated to prevent running several plants inefficiently at light loads when one plant running at full load will supply the demand.

Alex Holliday of the Indiana Fuel Administration discussed the economic aspects of the present national

policy of centralization and outlined the organization of the Indiana Fuel Administration.

T. A. Wynne, Jr., of Indianapolis, read a paper on "Proper Boiler-Room Management." President J. P. Ohmer of Elkhart complimented the association's coal committee on its efficient work in helping the smaller utilities. Saving coal by making the daylight-saving law apply throughout the year was a live topic of discussion.

On the suggestion of C. C. Perry of Indianapolis, E. J. Condon of Angola and Thomas Donohue of Lafayette, a resolution was passed placing the association on record as favoring a movement to set the clocks ahead during the whole year instead of only during the summer. A copy of the resolution is to be sent to the Fuel Administration.

Practically the only portion of the program not pertaining to coal conservation was an address by Governor James P. Goodrich, of Indiana. The Governor, who is a director in several utility companies, expressed sympathy with the central stations in their present difficult rate situation. The following officers were elected: President, T. A. Wynne, Indianapolis; vice-president, P. H. Palmer, Kokomo; secretary-treasurer, Thomas Donohue, Lafayette. Executive committee: J. P. Ohmer, Elkhart; S. W. Greenland, Fort Wayne; E. J. Condon, Angola; C. O. Murphy, Indianapolis, and F. J. Haas, Evansville. The advisory committee comprises:. J.M. Robb, Clinton; Thomas F. English, Muncie, and E. M. Walker, Terre Haute.

LABOR BOARD'S DECISION IN GENERAL ELECTRIC DISPUTE

Hours of Work Remain Unchanged but Increases in Wages Are Given and a Minimum Wage Scale Established

The National War Labor Board on Aug. 2 handed down its decision in the wage and time controversy between the Metal Trades Council and the General Electric Company of Schenectady. The decision is along the lines which Vice-President George E. Emmons conceded to the men. The award is as follows:

The present bonus of 10 per cent shall become wages.

For men there shall be a horizontal increase of 10 per cent in day and piece rates, except in the following trades: Steamfitters, carpenters, wide and narrow-gage men, painters, metal polishers and pattern makers, who shall receive an increase of 15 per cent.

Men employed on night shifts shall receive compensation 5 per cent higher than those employed on day shifts.

In no case shall any male employee, twenty-one years or over, receive less than 42 cents per hour.

In all classes of employment there shall be an increase of 20 per cent in the wages of all adult women.

No woman shall receive less than $15 per week.

In all cases where women perform the same work as men, their pay shall be the same.

In the case of the scrub woman, a minimum wage of $10.50 per week for the present hours of service is granted.

In calculating the overtime rate for piece work, the piece price shall be used as a basis and not the day rate.

The complaint submitted by the clerical workers was presented at such a late hour and the evidence is so unsatisfactory that an award will be postponed for further evidence, to be taken by the examiner assigned to supervise the execution of this award.

The evidence in this case shows that prior to the submission of this controversy to the arbitrators, the employees demanded a forty-four-hour week, and that subsequently this demand was altered to a request for a forty-eight-hour week.

Inasmuch, however, as the women in this plant are at this time working only forty-eight and one-half hours per week, and the men only fifty hours, the difference is so slight that we concluded, without passing on the merits of the length of the workday, not to change it at this time, because of the very great difficulty that would be involved in applying the present wage scale to these small changes of hours.

For the purpose of securing the proper interpretation of the award, the secretary of the National War Labor Board shall appoint an examiner who shall hear any differences arising in respect to this award between the parties, and promptly render his decision, from which an appeal may be taken by either party to the arbiter making this award. Pending the appeal the decision of the examiner is to be binding.

This award is to take effect as of May 3, 1918, for piece work and May 6 for day work, and shall continue for the duration of the war, except that either party may reopen the case before the arbitrators at periods of six months in intervals, beginning February, 1919, for such adjustments as changed conditions may render necessary.

The company shall have until Sept. 15, 1918, to make back payments of wages herein awarded.

THE SITUATION AT LYNN, MASS.

Striking employees of the General Electric Company's Lynn (Mass.) factories returned generally to their work on Friday morning, Aug. 2, following the War Labor Board's assumption of jurisdiction in the case. On July 27 the State Board of Arbitration issued a finding recommending that the employees return to work on the 29th, and that questions of wages and hours be adjusted between the company and its employees after the latter had returned to work, subject to the arbitration of the board in case of dispute. The board also recommended that no discrimination against members of labor unions be practiced by the company and that the principle of the open shop be recognized by the parties. General Manager W. C. Fish at once agreed to the recommendations of the board, but the striking employees refused to return until the War Labor Board assumed jurisdiction. Secretary Wilson of the Department of Labor requested the War Labor Board last week to take over the adjustment of the strike, and after wiring the State Board of Arbitration for information and receiving a reply from that body to the effect that it would be agreeable to intervention by the national board, the latter took over the case as mediator, influenced in no small degree by urgent appeals by representatives of the War and Navy Departments. The strikers promptly voted to resume work, and the company announced that it would welcome the resumption of production and accept the mediation of the War Labor Board subject to the withdrawal of the State Board from the case.

About 9000 employees returned to work, many hundreds having previously withdrawn from participation in the strike and resumed their old places. It is noteworthy that only a few cases of violence occurred during the strike. The company's property was carefully guarded, but little or no attempt was made to molest it. Twelve turbines were shipped from the factory on Wednesday of last week, despite the strike. Hearings were begun by the representatives of the War Labor Board, Alpheus Winter, chairman, on Monday morning at Lynn.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Should Stimulate Business.—Criticising rates submitted by the Athens electric light plant, the Illinois Public Utilities Commission comments: "It would certainly not operate to develop the business in a community of this character. Obviously, the aim of the utility should be to secure as large and liberal a use of its service as is possible."

Percentage Increases in Operating Cost.—In authorizing a war surcharge of 41 mills per kilowatt-hour on power rates for the Marion Light & Heating Company the Indiana Public Service Commission says in part: "The present power rates of the petitioner are low. They were made on a competitive basis. The competition is potential. That is, the rates cannot be made much higher than it would cost the individual power user to produce his own electrical energy with an individual plant. The existence of this point of potential competition is the chief justification for power rates so low in proportion to domestic and commercial rates. Last year the Public Service Commission made investigations which revealed that Indiana industries generating their own power showed operating costs greatly increased over those of 1915, the increases ranging from 15 to as high as 80.9 per cent. Since that investigation these percentages have increased and now range from at least 25 per cent to 80.9 per cent. This has the effect of raising the point of potential competition, and there is no longer any reason why power rates should be so disproportionately low. Except for the municipality of Fairmount, no power patron raises objection to this."

War-Time Service.—Where it appeared that, on account of abnormal conditions, the utility was unable to render the type of service desired by he consumer, but had contracted to supply a service more expensive and less adapted to the consumer's needs, the Illinois Public Utilities Commission required the utility to bill such substitute service on the basis of the service desired by the consumer. The case affects the East St. Louis Light & Power Company. The commission says in part: "The East St. Louis Light & Power Company obtains its power from the circuits of the Mississippi River Power Company and from several steam generating plants in East St. Louis and vicinity, and also by means of an emergency connection with the system of the Union Light & Power Company in St. Louis. The energy received from the Mississippi River Power Company is at 25 cycles, and the respondent distributes this energy by means of its distribution system and also distributes energy at 60 cycles.

The supply of 60-cycle energy is furnished from the stations of the company either by means of conversion apparatus, by which it is converted from the 25-cycle energy received from the Mississippi River Power Company, or by means of steam generating apparatus, by which the 60-cycle energy is primarily generated. Prior to the war the East St. Louis Light & Power Company had available what it regarded as a normal reserve for the supply of both 25-cycle and 60-cycle energy. When the demands of industries whose business was increased on account of the war made themselves felt, the East St. Louis Light & Power Company was called upon for additional service to such an extent that its available capacity in 60-cycle energy was utilized to as great an extent as the company felt could safely be done without jeopardizing the character of the service. Its supply of 25-cycle energy, however, was not entirely utilized. It appears that the complainant was willing to utilize 25-cycle energy, making the necessary investment in motors which were more expensive than would otherwise have been the case, and undergoing the inconvenience of the necessary complications in its operations, but did not wish to be penalized through its bills for service because of the inability of the East St. Louis Light & Power Company to supply energy of the same character which previously was furnished.

It does not appear reasonable that under these conditions the complainant should be required to pay an additional amount for service of a character which is less adapted to its requirements, provided that the service is of a permanent character which would assist in the normal development of the utility's normal business. Whether or not the service desired is of this character is best evidenced by the willingness of the consumer to contract for a period of time which under normal conditions would warrant permanent investment in needed facilties.

In the opinion of the commission, for service of this character such a period of time would be approximately five years. The condition which is illustrated by the complainant herein must be regarded as an emergency condition and one which warrants emergency treatment. For this reason the commission believes that a proper solution would be reached by billing the service of this complainant at the rates applicable to 60-cycle service and by combining, in so far as is physically possible, the meter readings for the two services. This method of billing should not be applied to consumers who, on account of a peculiarity of their manufacturing processes or for any other reason, desire service at both 60 cycles and 25 cycles. Neither should this billing method be applied to consumers who previous to the existing emergency were receiving service at both 60 cycles and 25 cycles."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 239 of this number.

Electrical League of Cleveland.—On Aug. 3 the Electrical League of Cleveland held its annual picnic at Nela Park. The event was attended by a large crowd and various entertainments were held.

Synchronous Club of Los Angeles.—On Aug. 1 an election of officers was held by the Synchronous Club of Los Angeles. Present officers are C. A. Blair, secretary, and N. B. Hinson, chairman entertainment committee.

New York & Queens Electric Light & Power Company.—L. J. Montgomery has been elected president and J. A. McKeon has been elected secretary of the Employees' Association of the New York & Queens Electric Light & Power Company for the period ending 1920.

British Columbia Association of Contractors and Dealers.—The secretary, Captain W. J. Conway, 406 Yorkshire Building, Vancouver, B. C., announces that the annual meeting of this association will be held Sept. 13, 14 and 15, 1918, at the Empress Hotel, Victoria.

N. E. L. A. Michigan Section.—The Michigan Section of the National Electric Light Association will hold its annual convention on Sept. 17 and 18 at the Pantlind Hotel, Grand Rapids, Mich. The program will be given over entirely to subjects of war-time interest. All technical discussion that does not point directly to "Winning the War" will be avoided. Capt. Thomas Chandler, president of the Michigan Section, is now in France, so the meetings will be conducted by Vice-President W. M. Lewis of Muskegon.

American Society for Testing Materials.—"Engineering Societies: Their Utilities and Justification" was the subject of the address made by President William H. Bixby before the recent annual meeting of the American Society for Testing Materials in Atlantic City, N. J. He referred to the hundreds of technical societies which are in existence in this country and outlined a basis for determining which should be called societies, clubs, institutes, etc. The original purposes of technical societies are fast being replaced by new ones, he pointed out. Among their present benefits are the opportunity they offer men of one profession to get acquainted and exchange ideas and the chance afforded to overcome engineering problems, improve processes, standardize materials and finished products, etc. The engineering society which is the most important and useful to-day is the one which gives the most beneficial results to the general public rather than to the individual member.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Swedish Production of Electrical Goods.—Figures on the output of electrical machinery, apparatus and transmission lines by Swedish concerns as contained in recent recapitulation by Swedish Exports follow: 1912, $6,500,000; 1913, $8,000,000; 1914, $9,000,000, and 1915, $12,000,000.

Wisconsin Company Is Financing.—The Wisconsin Power, Light & Heat Company, of which Marshall E. Sampsell of Chicago is president, is marketing $200,000 worth of three-year 7 per cent collateral gold notes, in denominations of $100, $500 and $1,000, through the Fort Dearborn Trust and Savings Bank, Chicago. The company operates in twenty-two communities in Wisconsin.

Boiler-Room Conservation in Ohio.—M. S. Hopkins, formerly connected with the Columbus Railway, Power & Light Company, has been appointed administrative engineer of the Ohio Fuel Administration by Administrator J. H. Frantz. Under his direction a campaign of education will be carried on to bring about improved firing conditions in boiler plants with the idea of conserving fuel. Mr. Hopkins has been authorized to employ assistants to aid him in this work.

Field Artillery Central Officers' Training School.—A field artillery central officers' training school for civilians between twenty years and eight months and forty years of age and enlisted men of the army has been established at Camp Zachary Taylor, about 6 miles southeast of Louisville, Ky. The course will be about twelve weeks. Civilians entering this school must agree to serve in the army for the period of the war if they fail to receive commissions—those within the draft age by voluntary induction and those above the draft age by voluntary enlistment.

Capital Issues Committees.—Charles S. Hamlin, chairman of the Capital Issues Committee of the Federal Reserve Board, has announced the permanent organization of district committees on capital issues in each of the twelve Federal Reserve Districts. Among those who are members of the committees in their respective districts are: Charles A. Morss and Henry G. Bradley, Boston District; Charles A. Stone, S. Reading Bertron, Newcomb Carlton, George B. Cortelyou, Allen B. Forbes, George E. Hardy, New York District; Clarence M. Clark, Lewis Lillie, John Brooks, Ferdinand W. Roebling, Jr., Philadelphia District; Rufus C. Dawes, Louis A. Ferguson, B. E. Sunny, Chicago District.

Norwegian Power Plant Leased.—United States Vice-Consul H. E. Carlson reports from Christiania that $4,020,000 was appropriated by the Norwegian government on May 6, 1918, for the acquisition by purchase of the Glomfjord hydroelectric plant. Glomfjord is in the province of Norland, Norway. The government is to purchase the stock of the company at 18 per cent. There is to be leased to Herr Tilberg of Stockholm, Sweden, 45,000 hp. at $9.65 per horsepower for the first five years and for the following twenty-five years at $9.11 per horsepower. At the expiration of this time the contract may be renewed for an additional period of twenty years at the rate of $12.06 per horsepower. When the power plant has been completed it is estimated that it will have a capacity of from 80,000 hp. to 90,000 hp.

Government Residence Halls.—The Bureau of Industrial Housing and Transportation announces that contractors have been invited to send in bids for government residence halls planned for war workers in the District of Columbia. Groups containing unit buildings, each consisting of 150 rooms, will be erected at the Union Station Plaza and on the site bounded by Fourteenth, Fifteenth and B Streets and Ohio Avenue, Northwest. Each room will measure 9 ft. by 11 ft., and each will be provided with a clothes closet and running water, hot and cold. Shower baths and tubs and toilets will be provided for each group of about twenty-five rooms. The rooms are all designed for occupancy by one person. In the basements will be small supplementary laundries for the use of residents. Kitchenettes are planned also in the basements.

Fuel Economy Circular of University of Illinois.—The engineering experiment station of the University of Illinois has just issued a ninety-page booklet printed in four colors which shows that the average small power plant can save 15 per cent of its fuel by the exercise of greater care in equipment and operation. This means a saving of 12,000,000 or 13,000,000 tons per annum if applied throughout the country. The purpose of the publication, the title of which is "Fuel Economy in the Operation of Hand-Fired Power Plants," is to present to owners, managers, superintendents, engineers and firemen certain suggestions which will help them in effecting greater fuel economy and in determining the properties and characteristics of the coal purchased. Features of installation essential to the proper combustion of fuel are discussed, the practice to be observed in the operation of the plant is outlined, and the employment of simple devices for indicating conditions of operation is prescribed. Only a limited supply of copies of this publication is available for free distribution. Requests for copies should be directed to the Engineering Experiment Station, Urbana, Ill., and should specify "Circular No. 7."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission.—Though the power of the Public Service Commission is extensive and the act creating it should be construed in the same spirit in which it was enacted, still when a particular power is exercised by or claimed for the commission, it should have its basis in the language of the statute, or be necessarily implied therefrom, according to a decision of the Court of Appeals of New York (119 N. E. 848).

Cause of Death.—Where a servant touched a wire carrying 114 volts of electricity and he was burned and died almost immediately, although he was a strong, able-bodied man, the presumption was that the accident was the cause of his death, until overcome by contrary evidence, notwithstanding that electricity of such power would not ordinarily cause death, the Court of Appeals of Kentucky has decided (204 S. W. 152).

Injury to Climbing Boy.—No liability was incurred by an electric company, or by a city, because of injury to a boy who climbed a pole bearing wires set just inside a school yard where the boy had to get on the fence to reach the handspikes, he being ten or eleven years old, not mentally deficient, and knowing that climbing the pole was not permitted, the Court of Appeals of Maryland held (103 A 948).

Delay in Fixing Wires.—In an action for the death of plaintiff's minor child by coming in contact with a broken electrically charged wire, the admission of evidence of defendant's delay in repairing the wire for an hour after the accident was prejudicial error, in view of the concession of defendant that the wire belonged to it, the Supreme Court of New York, Appellate Division, held —Costello versus Buffalo General Electric Company (170 N. Y. S. 1006).

Water Rights.—Laws providing that the beneficial use of water is a public one and that any person may exercise the right of eminent domain to acquire any property or rights when necessary for the storage of water for, or application of water to, any beneficial use do not expressly grant power to condemn state property, the Supreme Court of Washington holds in Mason County Power Company versus Superior Court of Washington for Mason County (173 P. 19). Where no right to condemn state property exists, when proceedings therefor are instituted, subsequent legislation cannot retroactively affect the matter and grant the right of such condemnation the court further held.

Judge Harold M. McClure of Lewisburg, Pa., has recently been appointed a member of the Public Service Commission of Pennsylvania.

John J. O'Brien, vice-president and treasurer of H. M. Byllesby & Company, has been appointed a member of the Capital Issues Committee for the seventh Federal Reserve District.

H. P. Pitts, industrial engineer with the Pacific Gas & Electric Company, San Francisco, has resigned to become purchasing agent for the Liberty plant of the Bethlehem Shipbuilding Corporation at Oakland, Cal.

Edward C. Niles, president of the National Association of Railway Commissioners and of the Public Service Commission of New Hampshire, has been appointed manager of the short-line division of the Railroad Administration, Washington, D. C.

E. R. Holt, assistant superintendent of the electric lighting, power and gas departments of the Lynchburg (Va.) Traction & Light Company, has been appointed acting superintendent of these departments during the absence of W. G. Claytor, who has been commissioned a captain in the army.

H. R. Woodrow, who some months ago was appointed assistant chief electrical engineer of the New York Edison Company, had been assistant to the chief electrical engineer of the company since 1911. Prior to that he was associated for two years with Dr. E. J. Berg in post-graduate work at the University of Illinois.

G. M. Turner, who has had charge of the local electric station operated by the Independent Electric Company, Portland, Ore., for several months past, has been promoted to be district superintendent of the company, with headquarters at Winlock. Mr. Mason of Winlock will succeed Mr. Turner in Castle Rock.

C. C. Hogshead, who for a number of years has been chief engineer of the power stations of the Roanoke (Va.) Railway & Electric Company, has been appointed acting superintendent of the electric light, power and gas departments of the company during the absence of W. G. Clayton, who has been commissioned a captain in the army.

R. H. Tapscott, who some months ago was appointed assistant chief electrical engineer of the New York Edison Company, was for the eight years previous assistant to the engineer of the lighting department of the General Electric Company at Schenectady. Mr. Tapscott entered the employ of the General Electric Company on graduation from Union College.

W. G. Williams, results engineer of the Empire District Electric Company, Joplin, Mo., has been appointed engineer in charge of fuel conservation in the mid-continent field by the petroleum division of the United States Fuel Administration. The appointment is for the duration of the war, and Mr. Williams will have his office in Oklahoma City.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James B. Olson, who for the past thirty years has been prominently identified with the wire industry, on Aug. 1 joined the sales organization of the Okonite Wire Company, New York City. February last Mr. Olson resigned from the Habirshaw Electric Cable Company, of which he was assistant secretary and general sales manager. He had been connected with this company and its predecessor, the India Rubber & Gutta Percha Insulator Company, since 1894. His first connection with the wire industry was with the New York Insulated Wire Company in 1888. Four years later he went to Chicago, where for two years he was Western sales manager for the company.

C. A. Graves, president of the Graves Engineering Company, has been appointed assistant administrative engineer of the Fuel Administration for the State of New York. He will have charge of the work of the conservation division in the metropolitan district of the state, which includes Greater New York City, Westchester, Rockland, Nassau and Suffolk Counties. Mr. Graves before engaging in consulting engineering work was manager of the power bureau of the sales department of the Edison Electric Illuminating Company of Brooklyn. He was connected with this company in power sales work for nine years. He has also served on the gas engine committee and the power committee of the National Electric Light Association.

Morton G. Lloyd, electrical engineer in charge of safety work in the Bureau of Standards, Washington, D. C., has been appointed a member of the electrical committee of the National Fire Protection Association, to represent the Bureau. Dr. Lloyd was for many years a member of the scientific staff of the bureau, during the period of its early development. From 1910 to 1917 he was technical editor of the *Electrical Review and Western Electrician*. In 1917 he returned to the bureau and upon the resignation of W. J. Canada was put in charge of electrical safety engineering. Dr. Lloyd is a fellow of the American Institute of Electrical Engineers and has served upon its standards committee and various other committees. He is vice-president of the Illuminating Engineering Society and a member of its committee on lighting legislation. He is a member of the divisional committee on lighting of the advisory commission of the Council of National Defense, a member of the American Association for Labor Legislation and of numerous scientific and technical societies.

J. G. Fisher, distribution superintendent of the Drumright, Okla., division of the Oklahoma Gas & Electric Company, has been called into military service.

Patrick Fitzgerald, assistant superintendent of the Northern States Power Company, and Joe Colombo, also of the Northern States Power Company, Stillwater, Minn., division, have joined the army.

W. Graham Claytor, general superintendent of the lighting and power departments of the Lynchburg (Va.) Traction & Light Company, and the Roanoke (Va.) Railway & Electric Company, has been commissioned a captain in the National Army and granted a leave of absence from the two companies. Captain Claytor will engage in electrical engineering work with the construction division of the army. Captain Claytor was born at Bedford City, Va., and obtained his technical education at Virginia Polytechnic Institute, after which he took a year's course of practical instruction at the works of the General Electric Company. For the last twelve years he has been connected with companies engaged in the electric lighting, power and gas business.

F. H. Rickeman, for several years connected with the Interstate Light & Power Company (Northern States Power Company), Galena, Ill., has been appointed general manager of the company, succeeding W. R. Miller, resigned. This property is controlled by H. M. Byllesby & Company, Chicago, Ill.

W. R. Miller has resigned as general manager of the Inter State Light & Power Company (Northern State Power Company) Galena, Ill.

Obituary

First Lieutenant Edward T. Hathaway, son of F. B. Hathaway, Southwestern General Electric Company, Houston, Tex., died in France as the result of an aeroplane accident.

Abbot S. Cooke, president of the Cooke-Wilson Electrical Supply Company, Pittsburgh, Pa., died at his home on July 25 at the age of fifty-nine years. He was in the electrical supply business for twenty-two years.

George G. Caldwell, for a number of years construction engineer for H. M. Byllesby & Company, died of heart trouble on July 27 at Ottumwa, Iowa, where he was engaged on special construction work for the Ottumwa Railway & Light Company.

Captain Howard C. McCall, son of Joseph B. McCall, president of the Philadelphia Electric Company, was killed in action in France on July 20. Captain McCall, who at the time of his death was twenty-seven years old, was graduated from the University of Pennsylvania in 1909 and from the Law School in 1913. He won his captaincy at the second officers training camp at Fort Oglethorpe, Ga.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

CENTRALIZED GOVERNMENT PURCHASING SCHEME PROGRESSING

Electrical Goods Have Been Assigned So Far to Construction, Ordnance, Engineers and Signal Branches

Organization of the centralized purchasing scheme whereby the General Staff controls the buying of all commodities and supervises all contracts for the Army as outlined in the ELECTRICAL WORLD of last week, page 228, is rapidly progressing. Already assignment of purchases of a number of commodities has been made to the several branches of the War Department, and boards of review are passing on all contracts so as to insure a uniformity of contract control and provisions. The general administration of the scheme is under the direction of Brig.-Gen. Hugh S. Johnson, head of the purchase and supply branch of the division of purchase, storage and traffic of the General Staff of the Army.

So far the purchase of electrical commodities has been assigned to the following branches: *Construction.*—Electrical equipment and supplies, electric wire for heavy power. *Ordnance.*—Dry batteries and flashlights and batteries. *Engineers.*—Arc searchlights and electric-gas generator sets. *Signal.*—Electric wire, radio equipment, telephone and telegraph equipment. *Aircraft Production.*—Brass and copper tubing, electric wire and cable.

DOME-REFLECTOR STANDARDS ADOPTED BY MANUFACTURERS

As Conditions Warrant Various Other Types Will Be Discussed and Standards for Them Fixed Upon

The Associated Manufacturers of Electrical Supplies, through their reflector committee, have been working for some months over the problem of setting and adopting standard dimensions and other specifications for porcelain-enameled steel reflectors.

The difficulties attending this work were many, and, inasmuch as the physical properties of reflectors are directly dependent upon lamp dimensions, the development of standardized reflector designs was carried on by joint meetings of the committees of both the reflector manufacturers and the engineering departments of the various lamp companies. These joint meetings were the result of appreciation by the reflector manufacturers not only of the great advantages to be derived by the purchaser of standardized reflectors but by the lamp manufacturers.

As a result of these meetings certain standard dimensions and specifications for dome reflectors were adopted by the reflector manufacturers. These manufacturers will within a short time place upon the market dome reflectors under the trade name or designation of "R-L-M standard," meaning "reflector and lamp manufacturers' standard."

The outcome of the discussion of the character of the porcelain enamel surface was the adoption of a quality of enamel which is regarded as the most efficient for light purposes, considered from a standpoint of efficiency on one hand and elasticity and durability on the other.

The R-L-M standard reflectors for the present will be confined to the dome types for direct lighting and will be furnished in various sizes to receive lamps varying from 75 watts to 1000 watts, inclusive.

The adoption of these R-L-M standard reflectors marks only the first step in the development of reflectors by the committees. As conditions warrant, various other types of reflectors will be discussed and certain standards adopted. As soon as the conclusions of the committees have reached a point where their findings are sufficiently exact to be adopted by the reflector manufacturers and approved by the lamp manufacturers, such conclusions will be made public. More detailed information concerning the R-L-M standards will be published by the various reflector manufacturers individually.

HOIST MANUFACTURERS DISCUSS WAR SERVICE

Plants Are Now Heavily Booked Up for Government Orders, and the Problem of Securing Raw Material Becomes Critical

The Electric Hoist Manufacturers' Association held its June meeting at Montour Falls, N. Y., where the members of the association were the guests of the Shepard Electric Crane & Hoist Company. The general topic of the meeting was war service, and the general discussion was directed along lines for co-ordinating the experience and facilities of the electric hoist manufacturers to be of the most direct and efficient service to the government for war requirements. The electric hoist manufacturers are heavily booked up on government orders for war purposes, and the problem of securing raw material sufficiently in advance to meet government requirements promptly has become a critical one. The consensus of opinion of the electric hoist manufacturers is that government orders for war purposes should take precedence over all other orders, and if war requirements call for the complete output of all of the manufacturers of electric hoists, it will be desirable to refuse all other business.

ELECTRICAL EXPORTS STILL TO FALL OFF

April Figures Are $4,572,953 and Bring Total for Ten Months Ended April 30, Up to $44,494,572

Exports of electrical merchandise manufactured in the United States continue to fall below those for the corresponding months of 1917. The latest reports are for April last, which give electrical exports for that month as $4,572,953 as compared with $4,740,902 in April, 1917.

For the first four months of 1918 the exports of electrical goods amounted to $17,824,286, as compared with $18,428,062 in the first four months of 1917. In each of the four months the value of the exports was less than in the same month of 1917. Furthermore, prices in 1918 have been higher than in 1917, so that the volume of export business has fallen off much more than the mere values would show. It is interesting to note in this connection that the loss is by no means so great as the decrease in wire and cable exports.

April exports bring the figures for the ten months ended April 30 up to $44,494,572, as compared with $41,733,106 and $23,666,267 for the corresponding period one and two years prior respectively.

These figures are taken from the regular monthly com-

pilation of the Bureau of Foreign and Domestic Commerce. The tabulated report follows:

	—Month of April—		—Ten Months Ended April—	
	1917	1918	1917	1918
Batteries	$212,154	$268,294	$2,362,304	$2,770,627
Carbons	.....	130,577	.....	1,294,230
Dynamos or generators	164,337	307,911	2,041,161	2,111,289
Fans	63,700	104,503	336,468	532,922
Heating and cooking apparatus	.....	38,959	.....	436,311
Insulated wire and cables	653,379	457,354	5,930,585	5,031,951
Interior wiring supplies, including fixtures	122,230	136,471	899,005	1,253,454
Arc lamps	1,240	2,430	13,048	12,133
Carbon-filament lamps	11,653	7,365	121,108	130,317
Metal-filament lamps	215,739	278,150	1,440,490	2,397,840
Meters and measuring instruments	89,297	157,730	870,783	1,222,470
Magnetos, spark plugs, etc	.....	230,719	.....	2,839,220
Motors	643,719	560,071	4,818,684	5,502,785
Rheostats and controllers	.....	14,805	.....	159,373
Switches and accessories	.....	163,076	.....	1,892,256
Telegraph apparatus, including wireless	90,047	36,167	417,534	250,299
Telephones	206,588	172,912	1,513,435	2,040,335
Transformers	94,720	156,901	951,513	1,556,694
All other	2,172,099	1,348,558	20,016,988	13,060,066
Total	$4,740,902	$4,572,953	$41,733,106	$44,494,572

METAL MARKET SITUATION

Copper in a Very Unsatisfactory Condition as to Price and Delivery—Tin May Go Under Official Control

Speculation is rife concerning the exact status of the copper market. There is practically no change in the situation as reflected in this column last week. The conferences to be held this week and next between the different copper producers and the War Industries Board are subjects of importance to the entire electrical trade, and their outcome is being awaited with more than passing interest. What orders producers of copper are booking are at the price ruling at the time of delivery; and as buyers do not know what that price will be they find it difficult to figure cost price on material and goods of various kinds they are asked to sell or bid on. Copper consumers, including brass manufacturers and wire drawers, have been requested to file briefs with the board, giving in detail the quantities of metal recently ordered, from whom, and the ultimate disposition of the finished material.

Next to copper the supply of tin is a matter of concern to the manufacturers of electrical staples. The price of pig tin has not as yet been fixed by the government, but present indications make such action likely. The ruling price is ridiculous, and at that the metal is difficult to obtain. It is figured that orders for August-September shipment, would cost 85.65 cents a pound in 25-ton lots, the smallest quantity accepted for importation of Straits tin. Lead remains at 8.05 cents a pound, with few transactions. Antimony is active with price fluctuations. There is a scramble for copper and brass scrap.

NEW YORK METAL MARKET PRICES

	—July 29—	—Aug. 6—
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	13.00 to 13.25	13.00 to 13.25
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.35 to 8.50	8.45 to 8.55
Tin, Chinese *	94	92.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	11.50 to 12.25	11.50 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

CONTRARY to former years when the hot weather of July and August saw a general let-up in business, the electrical trade this summer is going right along, paying no attention to the heat. Commercial building is now at a lower stage than ever before, but the demands of the government have taken up all the available stocks thus set free. Priorities classification on raw materials is now making it difficult to serve ordinary commercial customers.

Fan stocks up to the present week except for 12-in. and 16-in. oscillators were still fairly large and many folks expected to carry fans over. It is doubtful, now, if such will be the case, particularly Chicago east. Appliance demand continues unabated. Large lamps are still short on the Pacific Coast.

Prices are still advancing. Should copper go higher, as some seem to think, more advances will follow. A number of concerns have withdrawn prices until the government announces its August copper price and policy.

NEW YORK

Jobbers express themselves as being well satisfied with the way business is going. Sales are keeping up in volume, with more than 75 per cent being government orders or for enterprises indirectly doing work or making material or furnishing goods for some branch of the military and naval service. As stated last week, jobbing houses are showing more anxiety and anticipate trouble in getting enough merchandise to supply their regular trade. If a jobber can render service, having the stock to make deliveries, he is in a position to do an excellent business. While government orders may exhaust a jobber's stock, the opinion prevails that he should be allowed replenishment under a preferential order. This is not the case all together, however, although efforts to bring this about have been tried. Nearly every order of any size before shipment by the manufacturer as well as the jobber must be identified as to destination and purpose.

Prices are changing frequently, with some new and higher quotations being noted in certain staples. Prices continue to be withdrawn with no new lists issued, quotations being made only on application with specific orders.

GENERATORS.—About 90 per cent of the capacity of some manufacturers is taken up with government orders. Deliveries to the trade are fair on commercial or trade requirements; that is to say, a lag of three or four weeks. It is hard to get material for certain requirements, and it is almost necessary to have a prority certificate.

HOUSEHOLD APPLIANCES.—The Home Devices Corporation has increased its prices on electric washing machines from $10 to $15 each, effective Sept. 1. Household appliances—sewing and washing machines, ironers, etc.—are being bought freely; and high prices do not influence the buying detrimentally.

LAMPS.—It is believed when the new contract scale is delivered there will be a sharp advance in prices. Labor is more than double its former cost. Girls who in normal times made $18 a week now earn $35. There is a scarcity of these operators and they are difficult to retain even at these prices. Other items are in the same proportion. Standard stocks are growing larger.

ELECTRIC MILKERS.—Machines of this description are strong sellers. Farming communities are enjoying affluence and are buying every labor-saving device irrespective of price. The producers are making a big drive this summer and fall in all agricultural sections.

COLLECTIONS AND CREDITS.—Jobbers are holding

down their settlements wherever possible to a thirty-day basis. Admittedly it is difficult to enforce the rule, excepting when drastic measures are taken. The Moral Risk Club at its weekly conferences are exchanging some interesting information on the subject. Credits are held close.

MOTORS.—Deliveries vary, but on two to three phase, 3 to 8 hp. rating, one leading Eastern manufacturer says the company is sixteen weeks behind. A great deal of repair work is on hand, customers rehabilitating their old machines for two reasons, namely: It is almost impossible to get new motors, excepting on long delivery; and the quality of the old motor is claimed to be much better and therefore worth overhauling. A new price list or discount sheet on a shorter basis is looked for in the near future. On government orders the use of motors are many and surprising. One manufacturer recently received specifications on motors for 5000 ice cream freezers for cantonments.

LAMP POSTS.—Lighting poles of iron were advanced 25 to 30 per cent in the last two months. No further increase is anticipated. The supply appears to be satisfactory and shipments and deliveries made in thirty days.

CHICAGO

Volume of business continues satisfactory and prices are still advancing. Direct government business and business which is indirectly traceable to government activities comprise a large part of the business being done. How large a part this really is may soon develop if the extension of the so-called "pledge" system continues. Jobbers are being asked by many of the manufacturers from whom they buy to sign pledges that they will sell materials or products only for work which is either directly or indirectly connected with government activities. It is expected that this will work no hardship on the jobber, as most of his business is already of government origin. It will affect the jobber's customers, however, because upon them lies the burden of the proof that their purchases are for the government's needs. This means that contractors and central stations when they want to buy goods will have to supply the seller with proof (in the shape of priority order or otherwise) that the material and equipment is needed for government work. This presents a problem when it is desired to purchase for stock. Another limitation on buying has been announced by the administrative engineer of the Illinois Fuel Administration. All orders for power house apparatus are subject to his approval. The manufacturers and jobbers are anxious that the trade should realize this situation and should patriotically comply with the government wishes.

Bates & Rodgers, a Chicago firm, has contracts to build a $10,000,000 nitrate plant at Toledo and a $5,000,000 shipyard at St. Andrews Bay, Fla.

SCHEDULE "I."—Edison plug cutouts (Schedule I material has increased in price 12.5 per cent.

WIRE.—All copper wire is on a 34-cent base in Chicago and it is expected that within two weeks it will be on a 36-cent base. This new increase will follow the granting of an increase to 27½ cents to the copper producers on Aug. 7, if the increase is made. Confidence that this increase will be granted is unshakable in Chicago trade circles.

CONDUIT.—Pipe is moving in large quantities, but all sales are being made on priority orders.

RAILROAD BUYING.—Maintenance material is about all that is being brought by railroads.

FANS.—Fans have not moved owing to cold weather.

ELECTRIC RANGES.—Manufacturers of electric ranges report that their business this year so far is slightly ahead of that for the season of 1917. This is considered remarkable because the 1917 business was extraordinarily good. The business this year is coming from entirely different sources, however, than those from which it was received before. Almost no business is being received from the large cities. One manufacturer reports that 172 small central stations have bought ranges this year which never before purchased an electric range. These stations, of course, are buying ranges in small quantities but in the aggregate it creates a considerable demand.

BOSTON

Trade has been very active during the past week, with the government a heavy buyer of equipment and supplies. It begins to look as if there would be little or no midsummer falling off in either the number or the value of industrial and war orders. In spite of the continued demand for electrical products, jobbers' stocks are still well maintained except in a few lines where the government has virtually closed down on shipments without some sort of priority classification. The extent to which money is being expended in war plant work is indicated by the fact that in one large government plant in the eastern Massachusetts district an average of $100,000 a day is going into construction supplies and apparatus, and this average must be maintained for months to come in order to equip the installation in scheduled time. The electrical machinery and supply market is one of many drawn upon in cases like these to contribute its quota to the carrying on of the war. Collections are fairly good. The small contractor is working largely on a hand-to-mouth basis, and such remodeling and old house wiring as he secures is handicapped by the difficulty in securing wiring material for other than industrial or direct war applications. After more than a fortnight of idleness the striking employees of the General Electric Company's Lynn (Mass.) factories returned to their tasks on Aug. 2, upon the agreement of the War Labor Board to determine the issues in the case. Prices show little change this week.

FANS.—Stocks are being lowered rapidly by the hot weather demand, the jobbers in many cases having disposed of a large percentage of the equipment on hand. It would not be surprising if a real shortage developed during the next fortnight.

ELECTRIC ROAD TRUCKS.—Steady growth in purchases is reported, with very little blowing of trumpets. It is intimated in dealer circles that increased garaging facilties are under consideration for Boston, and that if these are put into effect, there will be a good deal of new business to handle. The demands of the war in grain shipment and the high cost of feed are favorable to a wider use of electric trucks.

LAMPS.—The supply of ordinary sizes is steadily increasing. Large quantities of lamps are moving into war service all the time, but manufacturing facilities are greatly expanded, and reserve stocks will be in excellent shape to meet the winter business, according to present indications. It is unnecessary for central stations and jobbers to attempt to carry large reserve stocks in this district in view of the effects of fuel saving activities upon the volume of lamps consumed.

STORAGE BATTERIES.—Trade is brisk, with deliveries somewhat better, probably owing to enlarged and improved manufacturing facilities. Good stocks of batteries for automobile use are now to be found in Boston. Prices hold firm.

CONDUIT.—Stocks are spotty and the supply of new pipe is limited mainly to war service orders and to delayed arrivals of orders placed months ago. "Priority" is the password for conduit shipments now. Even if certain sizes for stock become exhausted, little can be done about it at present. In more senses than one, the government is exercising an ironclad control of the supply.

APPLIANCES.—Sales are less active, partly because of the vacation season and also on account of the present conservative central-station policy regarding new business. Retail stocks are still in good shape, but the outlook is not attractive for any very extended commercial development at this time, with the exception of labor-saving devices.

TRANSFORMERS.—Deliveries are improving, two to five months being quoted against seven to twelve months in the early spring. Probably 90 per cent of the orders are for the government. Prices are steady.

GENERATORS.—Deliveries are still relatively poor, even on smaller sizes. Recent demands for water-wheel driven machines have pulled heavily upon the manufacturers. Large steam turbines are now to be obtained only through governmental sanction, and this of course limits the sale of big units to war service or allied work.

ATLANTA

Normal activities in the electrical field have gradually gravitated to government account without any material economic disturbance, as evidenced by the fact that a great volume of business is now being transacted, mostly for war essential requirements. The volume of sales in all lines is well sustained, and, while shipment of steel products has materially lengthened, delivery on other classes of goods has shown some improvement.

This section will be greatly helped by the organization of the War Industries Regional Committee, covering Georgia, North and South Carolina, and Florida, for the proper distribution of war orders.

The recent apportionment by the government of the labor quota for the various states will help this section, and, although the quota at this time is very small, compared with that of the larger industrial centers, it will be increased from time to time.

Manufacturers report an advance in prices on a number of articles, beginning Aug. 1, and at the same time all new orders after this date will be closely scrutinized to determine whether goods so ordered are to be used for essential industries. It is not expected that requirements of this nature will cause any material loss in orders.

The petition of the National Association of Railways and Utilities Commissioners to the President suggesting an organization of a federal commission for the purpose of co-operating with the various state commissions for the purpose of determining the necessary rate increases of utilities indicates brighter prospects for relief.

Government authorities are fully cognizant of the shortage of power and realize that a general increase in rates will permit some utilities to continue their contemplated water-power plants. While a few of the Southeastern water powers have secured some relief this week, in the form of a light rainfall, the drought is not broken, and the water-power companies of this section are about holding their own.

The Georgia Railway & Power Company has not cut off its primary customers, and it is hoped that this will not be necessary, as sufficient rain is expected daily, especially as the precipitation on this company's drainage area is 25 per cent off up to Aug. 1.

FANS.—There is practically no movement in this line, as the temperature recorded during the past two weeks is considerably below normal.

TRANSFORMERS.—The demand for distributing types remains comparatively active. Southeastern stocks on this type show signs of accumulating. The call for larger power type is spasmodic, requirements having fallen off owing to lack of power for new business, and hesitancy on the part of central stations to make extensions.

SEATTLE-PORTLAND

Well-sustained volume of sales marked the last week in July throughout the entire Northwest. If anything the volume was a little larger than the previous week. Increases prevail generally throughout trade. As usual, war industrial plants predominate in the buying, although commercial orders and central-station buying show a slight increase. Sales to the government show but little fluctuation. Last week the sales of power apparatus showed a slight increase. Jobbers in the Puget Sound district particularly report a good demand. Stocks are in fair condition. The conduit situation is unimproved and stocks are still hard to obtain while the demand is insistent. Shipments are cleaned out as fast as obtained. Everything is difficult to obtain. All of the larger equipment must come through government orders and it is believed that shortly everything will have to be obtained through the same channels. The government at present is commandeering some items from jobbers' stocks. Jobbers are trying to stock up for fall business on all lines of material and equipment in expectation of an increased shortage and increasing disordered freight conditions. The freight situation is even worse, if possible, with absolutely no prospect of improvement. Emergency Fleet Corporation awarded contracts for fourteen 8800-ton steel ships to the Ames Shipbuilding Company, Seattle. Contracts for all wooden ships that the Foundation Company can build at Portland, Tacoma and Victoria plants during the remainder of the year and probably all of next are assured by the French government. Labor shortage in every industrial line is growing worse and the recent announcement of the Emergency Fleet Corporation that only employees whose loss would retard ship production will be given deferred classification in the draft threatens further to aggravate conditions in the shipbuilding districts.

SMALL MOTORS.—During the past week sales to industrial plants increased. However, no large special orders have come through for the past month. Stocks are low.

DOMESTIC APPLIANCES.—Sales are very satisfactory, particularly with washing machines. Ranges are moving well although not above normal.

LAMPS.—The situation regarding large sizes shows no improvement. The demand for larger lamps is active. Smaller sizes are coming through promptly and demand gradually increasing due to residence construction.

SAN FRANCISCO

Business continues excellent, railroad deliveries are good and the only rift to be discerned is the coming shadow of government priority regulations on certain commodities, which will limit their sale to war work.

New government building reported includes additional barracks at Tucson, Ariz., and a new hospital and other service building for the Oakland shipyards. A new packing plant for Elmonte, Cal., is under way and the Union Oil Company is adding to its tank equipment at Oleum. The Newberry Electric Company has been awarded the contract for the electrical installation in the new factory of the American Can Company at Fruitvale, Oakland, one item of which covered the installation of sixty-six motors.

The United States Food Administration has recommended that a huge tract of nearly 20,000 acres of farm land of the Middle Sacramento Valley be irrigated from the Lake Almanor supply, to prevent the crops and orchards on that tract from dying.

STREET LIGHTING.—The municipalities at San Mateo, Oceanside, San Diego and Los Angeles have instigated plans for improved lighting of certain districts. On the other hand, all bids for Fresno's proposed electrolier system have been rejected, since the city trustees acknowledge the wisdom of the Federal Reserve Bank communication requesting that cities economize as far as possible.

WIRELESS.—The great cost wireless demand caused by the many important stations and the government radio schools, such as that at Goat Island, have made it necessary for the building of California factories for the local construction of wireless material. The federal plant at Palo Alto will be doubled immediately.

BATTERIES.—Dry batteries have advanced slightly to meet new freight-rate conditions, the advance being on the basis of $1, $1.70 and $2.80 per hundred respectively for the 6, 7 and 8-in. standard sizes. The demand is enormous, ordinary maintenance calls being enhanced by the increased number of vehicles and by auxiliary construction to supplant natural irrigation. Samson and Edison batteries have increased 10 to 15 per cent.

WASHING MACHINES.—The dealers conservatively estimate that their sales would be doubled providing Eastern factories could cope with the orders placed with them. Recent sharp advances in prices have become effective, so that in general the dolly wooden machines now call for $60 on the Pacific Coast, standard machines for small families $100 and machines for families of four or five people for $135, which are increases from 15 to 20 per cent.

VIBRATORS.—The enormously increased cost of production has caused an advance of from 5 to 10 per cent in the selling prices of cheaper vibrators. Sales are steady, also slackened somewhat from the demands of last spring. On the other hand the allied line of drink mixers is in high favor and local stock is in poor shape. The growing prevalence of dry laws and the increasing number of dry sections have caused the conversion of saloons.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00 to $80.00
Coil to 1000 ft	5% to 75.00
	No. 12 Solid
Less than coil	+20% to + 5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.319 to .322	.329 to .332
Barrel lots	.289 to .292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$69.75
½-in. double strip	75.00	72.00
¾-in. single strip	100.00	93.00
¾-in. double strip	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00 to $78.75	$63.75 to $71.25
½-in. double strip	78.75	71.25
¾-in. single strip	100.00 to 105.00	75.00 to 95.00
¾-in double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$55.00	$24.45	$21.50
½-in.—	60.00	27.00	23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.50
½-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5% to 1½%	+3% to 3½%
2500 to 5000 lb	+2% to 4½%	List to 6½%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00
Discount	30%

CHICAGO

List price	$5.00 to $7.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00
1/5 to std. pkg	4.50

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	$5.15 to 5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.90
Coil to 1000 ft.	26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.00
Coil to 1000 ft.	25.00 to 26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 620, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$38.00
1/5 to std. pkg.	19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $24.15
1/5 to std. pkg.	14.80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$20.00	$30.75
1/5 to std. pkg.	15.60	24.00

CHICAGO

	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$9.48 to $18.40	$30.75 to $36.80
1/5 to std. pkg.	$8.88 to $16.00	24.20 to 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to 10%
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100 amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	+10% to 11%
$25 to $50 list	+14% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	8%
Std. pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List to 16⅔%
Std. pkg.	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	60%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	15% to 30%
$2.00 to $10.00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.50
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$.434
No. 18, full spools	.384

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.69
No. 18, full spools	.55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00	$15.00	$11.25
12	27.10	23.20	17.05
10	37.80	32.40	23.75
8	53.35	45.70	33.35
6	84.40	72.35	53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.00–$21.00	$14.00–$16.00	$12.50–$13.25
12	27.53– 28.70	25.86– 28.70	24.50– 32.02
10	33.02– 40.10	30.48– 40.10	27.44– 34.23
8	46.09– 56.50	42.54– 48.23	38.99– 41.34
6	61.30– 91.18	61.76– 77.84	52.18– 66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$38.40
25 to 50 lb.	36.40
50 to 100 lb.	32.40

CHICAGO

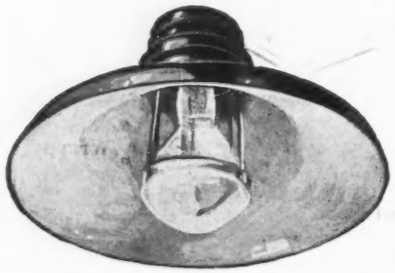
	Per 100 Lb. Net
Less than 25 lb.	$37.00 to $39.72
25 to 50 lb.	36.00 to 38.72
50 to 100 lb.	35.00 to 37.72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lamp Shield for Eliminating Glare

In order to soften the glare from a reflector unit in using gas-filled lamps of high intrinsic brilliancy, the Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, is manufacturing a device shown in the accompanying illustration which consists of a glass or metal

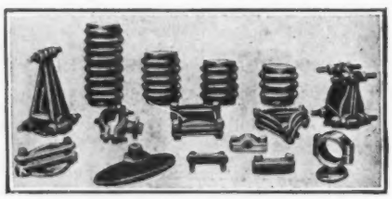


GLASS BOWL BENEATH LAMP FOR SEMI-INDIRECT DISTRIBUTION

bowl inserted under the lamp. This device may be adapted to reflectors of any shape and is very easily removed for cleaning.

Interchangeable Insulating Supports

To meet the needs of central stations and industrial companies erecting bus-bar and control apparatus under diverse voltage conditions, the Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, has designed a line of post-insulating supports with interchangeable parts. The porcelain unit consists of a corrugated post made by the wet process. Each porcelain unit is guaranteed to stand a side thrust of 900 lb. (408 kg.) and a tensile



STANDARDIZATION LIMITS USE OF SPARE PARTS

pull of 1800 lb. (816 kg.) The number of corrugations depends on the working voltage for which the post is intended, different styles being provided for 3500 volts, 7500 volts, 15,000 volts and 25,000 volts respectively.

Into the end of each of these posts metal thimbles are cemented. To the thimbles the various bus holding and mounting fittings are attached, thus forming the complete support. The fact that any fitting may be attached to any post gives great flexibility. A further feature is that all supports are adjustable in both horizontal and vertical planes. The clamp for supporting vertical bars is also provided with adjustment which permits it to accommodate a vertical bus of any thickness from 0.25 in. to 2.25 in. (0.63 cm. to 5.72 cm.)

Motor-Operated Surfacing Machine

The Cavicchi Polishing Machine Company of Quincy, Mass., has developed two sizes of one-man motor-operated surfacing machines for tile, marble, granolitic and composition floors. A finish flush with the side walls is obtainable by means of a wheel composed of concentric sections operating independently of each other. Irregular surfaces can be made uniform and smooth. The machine is actuated by a General Electric 2-hp. motor, the speed of which is controlled by the switch and rheostat on the handle of the machine.

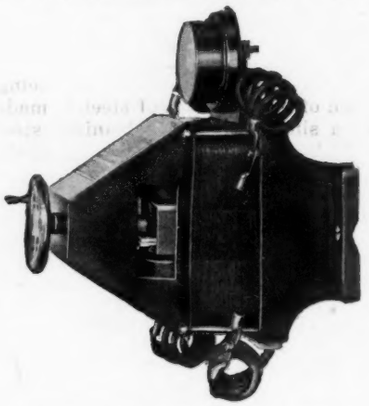
SUITABLE FOR FLOOR MAINTENANCE OF BUILDINGS

Compensator for Motion-Picture Projection

To give the close regulation of current essential for tungsten motion-picture projection lamps, the General Electric Company, Schenectady, N. Y., has developed a "compensarc," the type I, form B, shown herewith.

Protection against over-current and regulation to within 0.1 amp. is obtained, according to makers. The device operates on the reactance principle and is furnished for standard voltages and frequencies in ratings of 20 amp. and 30 amp., corresponding to the "mazda" lamps now on the market for this purpose.

The "compensarc" may be installed within convenient reach of the operator, who can watch the ammeter and control the current by the hand wheel shown in the illustration. It is made of a two coil auto-transformer stacked



REACTANCE-TYPE REGULATOR FOR TUNGSTEN LAMPS

with standard transformer punchings within a rawhide housing, the complete wiring of which forms the line side with the lamp terminals tapped across one coil. The coils are stacked so that room is left between them for an iron leakage plug in each side of the magnetic circuit. Turning a hand wheel on the shaft of the iron plug moves it in and out between the two coils giving a very close adjustment for the lamp. Maximum reactance is obtained when the plug is completely in place. The only noise is a slight humming when the plugs are being withdrawn and this ceases when they come to rest.

Alternating-Current Magnetic Switches

For many special motor or electric control applications the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., has developed its type KB magnetic switches. The magnetic frames of these switches are made up of laminations of thin electrical steel, and the rest of the switches are made up of punched steel and copper parts, wherever possible, to secure the greatest electrical and mechanical properties with the least weight in order to make the switches quick-acting.

To overcome the low humming sound characteristic of alternating-current

apparatus, which is sometimes an objection when it is installed in churches or theaters, these switches can be furnished so that they are held in the running position mechanically. The operating coil on the noiseless switches closes the switch and latches it in and opens its circuit. Then to open the switch a smaller coil is energized which trips the latch. With this arrangement the coils are not connected to the line except during the very short time consumed in opening or closing, so that the noise is entirely eliminated.

Flexible Steel-Armored Conductors

For interior wiring of light and power the Sprague Electric Works of the General Electric Company, New York, have developed an improvement on their single-flexible cable. The armor of this cable, instead of being formed of double strips of steel, is made with a single strip of galvanized steel interlocked and gasketed, the whole armor complying with the new code standard. It is light in weight and very flexible. At present this flexible cable, known as type S.S., is manufactured only in No. 14 B. & S. gage wire. Later it is expected that three-wire and other sizes will be supplied.

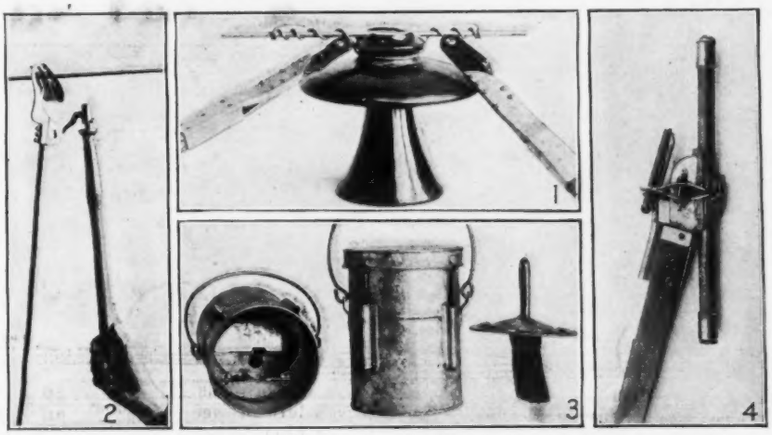
Easily Reparable Inter-Office Telephone

All of the internal parts except the magneto and the batteries of the "Victory" telephone are mounted on the swinging door. This door may be easily removed from the cabinet by pulling the hinge pins which are provided with extensions for use as handles. This method of arranging the interior parts was developed to facilitate repairs. Other features of the instrument, which is suitable for private industrial or central-station telephone systems, are that it has a single bell with double clapper and that has a writing slate above the mouthpiece on a level with the user's eyes. It was designed by J. Skinderviken and is manufactured by the Skinderviken Telephone Equipment Company, 2136 North Clark Street, Chicago.

Convenient High-Tension Line Tools

Some very practical devices for use in high-tension line work are made by the Bush Electric Tool & Manufacturing Works, Redlands, Cal. Fig. 1 shows how a defective insulator may be removed from circuit without interrupting the service. Two "hot-wire cutters" are shown in the process of cutting the tie wire to free the line conductor while the old insulator is taken out and replaced. The handles are impregnated to permit working on live conductors subjected to pressures up to 30,000 volts without additional insulating means.

For "shorting" or grounding lines to protect workmen against accidental closing of the circuit during repair the grounding clamp shown in Fig. 2 is useful. The wooden handles make the clamp safe and convenient to use.



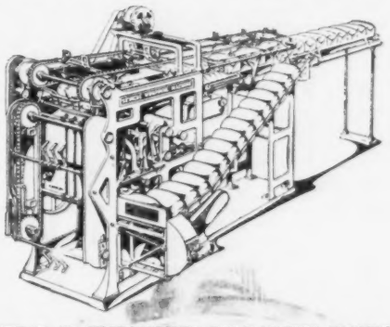
FIGS. 1 TO 4—HIGH-TENSION LINE TOOLS AND ECONOMICAL BUCKET

In Fig. 4 is shown a "fuse grabber" in employment to remove a fuse from a live circuit. The jaws are faced with rubber for gripping the fuse. It is said that the device may be readily and safely slipped over the fuse, automatically tightening its grip. It may be used for removing glass as well as fiber fuses.

A considerable saving in paint may be effected by the use of the special bucket shown in Fig. 3, according to the makers. The cover is made air-tight, thus keeping the paint and brush in good condition. About a third of the way down the bucket is shown a special brush-holding and wiping plate. When the brush is pulled through the rectangular opening in this plate the surplus paint drips back into the can instead of over the sides. It is pointed out that workmen will accomplish more and do better work with this paint bucket because the brushes will be in good condition. The bucket may be filled with water and used also to keep idle brushes away from the evaporating influence of the outer air.

Sanitary Bread-Wrapping Machine

Bread wrapping has become a regular part of bread production as a result of public demands that it be delivered to the customer clean, sanitary and unhandled. Obviously, wrapping must be done by machinery to insure these results and to perform the operation at lowest possible cost. As a result of this



BREAD IS UNTOUCHED BY BAKERY HANDS

requirement the National Wrapping Paper Company of Nashua, N. H., has developed a motor-operated wrapping and sealing machine, under the "Sevigne" patents. This machine performs the entire operation of receiving the loaves from the ovens and delivering them ready to hand to the customer. Power for the entire operation is furnished by a fractional-horsepower motor made by the General Electric Company for the prevailing supply circuit.

Conduit Seal

Barnes & Irving, Inc., Syracuse, N. Y., are distributing a simple conduit seal that is used for closing the ends of exposed conduit at distributing boards or outlets. It is claimed that this seal makes an air-proof, waterproof and dirt-proof covering and that

INEXPENSIVE METHOD OF SEALING CONDUIT

it is especially desirable when used with conduit being laid in reinforced-concrete buildings because it eliminates concrete plugged pipes. This seal consists merely of a circular disk of cardboard, paraffine waxed and made in the various sizes for conduit.

Trade Notes

GOVERNMENT CONTRACTS—The following purchases have been made from and contracts have been awarded to the following firms: *Ordnance Department*—Wagner Electric Company, motors and transformers. *General Engineer Depot*—National Carbon Company, dry cells; National Electrical Supply Company, exhaust fans; General Electric Company, rheostats. *Navy Department*—Westinghouse Electric & Manufacturing Company, motors.

WIRE AND CABLE FOR AUSTRALIA.—An indication of the extent to which English manufacturers are taking steps to foster and protect after-the-war overseas trade in electrical goods is the recent decision of the Department of Trade and Customs of Australia to regard the use of the letters "C.M.A." on the labels attached to imported wires and cables as an indication that the manufacturers of the goods are associated with the British Cable Makers' Association and that the goods have been manufactured in accordance with the specifications of the association. The Department has also decided that statements such as the following, "Guaranteed equal in all respects to 'C.M.A.' product of similar grade," may be used on wires and cables manufactured by non-members of the British Cable Makers' Association, provided that the goods are thereby correctly described. It is interesting to note that prior to the war between 6 and 7 per cent of the exports of American insulated wire and cable went to Australia. The figures for the four years ended June 30, 1917, are as follows: 1914, $121,181; 1915, $64,304; 1916, $66,360, and 1917, $72,860. In the meantime the total exports of this line rose from $1,992,304 to $7,192,204. The increased demand, however, came largely from Europe and South America and it must be remembered represented a price hat had more than doubled.

ELECTRIC MOTORS FOR SPAIN.—A report in a London paper states that "Spain is endeavoring to be independent of German electrical motor appliances by establishing an Institute of Electrical Industries at Barcelona with a department specially equipped for research work in this direction."

APPLICATIONS FOR LICENSE TO EXPORT.—The War Trade Board advises that all applications for license to export must be filed on the application form X, dated April, 1918. Later editions of this form will be supplied as they are printed. Previous editions are hereby discontinued. On and after Aug. 10, 1918, the War Trade Board, Washington, D. C., and branch offices, will accept for consideration only those applications which are filed in accordance with this notice. To secure forms, exporters should apply to the nearest office of the War Trade Board.

FARM-LIGHTING PLANTS AT NORTHWEST FAIR.—Manufacturers of farm-lighting plants are to be well represented at the Northwest Interstate Fair, Sept. 2 to 7, according to the applications for space that have reached the Spokane office. Compared to three or four entries in former years, seven firms will have space near the automobile entrance this year, as follows: Domestic Engineering Company, Fairbanks-Morse & Company, Nixon-Kimmel Company, Western Electric Company, Washington Electrical Supply Company, Lally Electro-Lighting Corporation and Warner Lamp Company. All the concerns will demonstrate their systems and equipment on the grounds.

TRADE COMMISSION STOPS MORE PRICE MAINTENANCE.—After a full hearing the Federal Trade Commission has ordered the Cudahy Packing Company of Chicago to discontinue as being unfair its practice of compelling dealers to maintain its fixed resale price in the sale of "old Dutch cleanser," one of its products. The corporation, in a formal order by the commission, was prohibited from making agreements with dealers for the maintenance of the price and from discriminating in price or refusing to sell to dealers who resell at any price they choose. The case is important as it is typical of a class of cases before the commission where the manufacturer requires the maintenance of resale prices by the jobber but not by the retailer. It is provided that the company is not prohibited from issuing price lists, or from printing prices in its advertising or upon containers and cases containing its product.

THE WAR TRADE BOARD, Washington, D. C., has issued a revised trading with the enemy list in supplement No. 6. It contains additions, removals and connections from March 15 to June 28. The board has also announced, under date of July 20, regulations governing the exportation of postage, revenue and other stamps of similar character, either canceled or uncanceled. They amplify the order announced on May 14.

JOHN P. TOPPING has just rounded out his twentieth anniversary of service with the Bryant Electric Company of Bridgeport, Conn., and he is one of the pioneer Western representatives of the Eastern manufacturers. He was recently appointed assistant Western manager of the Bryant Company with headquarters at 323 West Jackson Boulevard, Chicago, Ill., Mr. Topping was born on Feb. 1, 1875, in Alton, Ill., and was first engaged in the wholesale hardware and iron business. In 1891 he went to Chicago, and prior to and during the World's Fair was employed by the Ansonia Electric Company. He next became engaged in the contracting business, and was employed in the construction department of the Northwestern Electric Light & Power Company of Chicago, until 1898 at which time he entered the service of the Bryant Electric Company. Since that time he has been continuously in the employ of the company.

THE UNIVERSAL MOTOR CIMPANY of Oshkosh, Wis., which was organized and began manufacturing in 1914, has since then increased the output of its product to such an extent that, judging from present indications, the sales this year will not fall far below $1,000,000. The accompanying picture shows a portion of the factory with a number of the employees assembled outside.

LABOR SUPPLY.—Distinctly favorable results from the war-time employment of women in the metal trades are shown in a report just completed by the National Industrial Conference Board. The report summarizes information obtained from 131 establishments employing 335,015 men and 49,823 women, and treats of the comparative wages and output of men and women, the hours of work, and numerous other matters of general interest and of practical value to employers contemplating the introduction of female labor. The investigation showed that no extensive substitution of women workers for men has as yet taken place in these trades. In ninety-five establishments only 10,657 women were employed on work formerly performed exclusively by men. In the main, the work of women has been confined to the lighter process in which rapidity and dexterity are more important than technical skill acquired by long training. The report emphasizes that work of a "repetitive" character is exceptionally well adapted to the utilization of female labor. Comparing the output of men and women, the report shows that in sixty-four establishments of the ninety-seven furnishing specific information on this point and where men and women were employed on the same processes, the output of women was equal to and frequently greater than that of men. In only fifteen establishments was the output of women less than that of men on all operations on which both were employed. In the remaining eighteen their productions, although less in some operations, equaled or exceeded that of men in others.

THE PYROLECTRIC INSTRUMENT COMPANY, 148 East State Street, Trenton, N. J., manufacturer of special type of electric furnaces, pyrometers, and other electric precision instruments, has removed its works to larger quarters at 636 East State Street, to provide for increased capacity and facilities.

C. H. PICNIC—The eleventh annual picnic of the employees of the Cutler-Hammer Manufacturing Company was held at Waukesha Beach, Pewaukee Lake, Wis., on July 27. The main office and works were closed for the day. A program of athletic events was provided for boys and girls of all ages. The prizes consisted of thrift stamps in various amounts.

EMPLOYMENT OF DISABLED SOLDIERS.—The Novelty Incandescent Lamp Company, Emporium, Pa., has been engaged recently in the distribution of Red Cross circulars encouraging the employment of disabled soldiers in industrial work. The company has not itself employed disabled soldiers as yet, because it has lost few employees—most of its employees being girls. In this connection the company states: "However, without doubt we would arrange to do at least as much in this line as any other concern, and it might be that the lamp-manufacturing industry would prove a mighty attractive opportunity for the boys meeting with misfortune."

TURBINE WORKMEN INDORSE SHIPBUILDING PROGRAM.—The Delaval Steam Turbine Company of Trenton, N. J., recently forwarded to Charles M. Schwab, Director-General of the Emergency Fleet Corporation, the following testimonial from its workmen, 492 in number: "We, members of the force of the Delaval Steam Turbine Company of Trenton, N. J., hereby express to Messrs. Hurley, Schwab and Piez and to the members of the Shipping Board, Emergency Fleet Corporation and their assistants our appreciation of their energetic and courageous work in the building of ships, and we assure them of our readiness to back them up and to help them in every way we can in their program to build the ships our country needs." To this spontaneous and patriotic pledge, Mr. Schwab made a suitable reply, stating that "Just such united action and willingness to put everything else aside for the good of the common cause is going to help us carry 'over the top' the greatest construction program ever known."

MORE LEAD FOR STORAGE BATTERIES IN ENGLAND.—The Electric Vehicle Committee of the British Electrical and Allied Manufacturers' Association, acting in conjunction with the storage battery makers' section, having represented to the controller of the priority department of the Ministry of Munitions the desirability of increasing the amount of new lead allowed to be used in the repair and maintenance of batteries under the special battery permit issued to storage battery manufacturers, where batteries for electric vehicles are concerned, the controller has now consented to an addition to Clause 15 of the special battery permit held by members of the section, to come after the words "Not exceeding 100 lb.," the words, "Or in the case of electric storage batteries used as the motive power for propelling electric vehicles, 300 lb. and provided always, etc." This addition has been designed to enable manufacturers of storage batteries for use on electric vehicles to repair and maintain same without the necessity of individual application for permits being made to the priority department.

THE MINISTER OF MUNITIONS of Great Britain has issued an order amending the glass control (consolidated) order of 1917, according to the London "Electrical Review." It has been found necessary to extend the provisions relating to electric lamp glass contained in the order to vitrite and other glass used or intended for use in electric lamp caps for insulating purposes which were by that order expressly excepted from the operation of such provisions. It is now ordered that as from May 7 the order shall read and take effect as if in clause 8 the words "and the expres-

sion 'electric lamp glass' shall include all glass used or intended for use in the manufacture of electric lamps, not excepting vitrite or other glass used or intended for use in electric lamp caps for insulating purposes, but shall not include glass shades and similar accessories," were substituted for the words "and the expression 'electric lamp glass' shall include all glass used or intended for use in the manufacture of electric lamps, except glass used or intended for use in lamp caps for insulating purposes, but shall not include glass shades and similar accessories."

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of Chicago, manufacturer of staples and specialties, has removed its executive offices to 806 Washington Boulevard.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburgh, Pa., states that the item in these columns in the July 27 issue saying that the company had completed arrangements for the erection of a new plant at Fords, N. J., was incorrect. The company has not yet, the letter states, even started arrangements for the erection of a plant.

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY, of Hartford, Conn., with a branch in Scranton, Pa., on July 19 bought a building to accommodate its business in Albany, N. Y., for $50,000. The company had for two years maintained an office only in Albany. A new building is planned to take the place of the one purchased, and later a large warehouse will be erected.

STERRETT & FLEMING, INC., of Washington, D. C., succeed Sterrett & Fleming, distributors of the Diamond Grid batteries for the District of Columbia, Maryland and Virginia. John A. Sterrett and Robert F. Fleming, composing the former partnership, retain their interests in the new company.

THE DAVIS SEWING COMPANY of Dayton, Ohio, has announced to the trade a new unit-type motor-driven sewing machine.

THE HART MANUFACTURING COMPANY of Hartford, Conn., manufacturer of the "Diamond H" switches and appliances, on July 15 appointed the W. A. McCombs Company, Union Arcade Building, Pittsburgh, Pa., its representative and distributer for Ohio, Pennsylvania east to Harrisburg, West Virginia and Kentucky.

THE NEW ENGLAND ELECTRIC LAMP COMPANY, INC., of Danvers, Mass., has begun the manufacture of renewed nitrogen lamps. The company was recently incorporated under the State law and is officered as follows: President, Oscar Bodwell; treasurer, W. A. Webb; secretary G. F. Cochran.

THE WESTERN ELECTRIC COMPANY has established a new branch house at Syracuse, N. Y., with H. C. Goldrick as manager. F. X. Baldwin, formerly in the distributing department of the New York City branch, to which a large territory in the East is tributary, is on the sales force at Syracuse.

THE BURKE ELECTRIC COMPANY of Erie, Pa., announces C. D. Miller as manager of its Buffalo (N. Y.) branch sales office at 509 Morgan Building, Pearl and Niagara Streets.

LYMAN G. MORGAN, formerly connected with the sales force of the National X-ray Reflector Company at Milwaukee, Wis., has resigned to go with the Western Electric Company in its Seattle office.

THOMAS N. MEHAN, who was formerly a salesman for the Electric Appliance Company of Chicago in the Central States, has joined the sales force of the Utilities Indemnity Exchange, Railway Exchange Building, St. Louis.

J. M. WEIMER, who has been sales engineer for the National X-Ray Reflector Company in its Chicago office, has been appointed representative for that company in its Wisconsin and northern Michigan territories. Mr. Weimer is planning to make his headquarters at Milwaukee.

THE WESTERN ELECTRIC COMPANY will increase its Hawthorne (Ill.) factory by the addition of four factory and warehouse buildings, five and six stories high, on a piece of ground measuring 675 ft. by 211 ft. The buildings, on which work is to be commenced immediately, will cost in the neighborhood of $1,000,000. The The company completed a seven-hundred-thousand-dollar plant extension in July, 1917, which, together with the four buildings just mentioned, will give it a total of seventy-three buildings of the most modern type.

THE SOTHMAN CORPORATION of New York City, engineers, with offices at 5 Beekman Street, have opened a branch at Pittsburgh, Pa.

THE FLASHLIGHT BATTERY COMPANY of New York City has filed schedules in bankruptcy, with liabilities of $46,823 and assets of $30,586, consisting of stock and machinery, $46,00; patents' copyright, etc., $10,000; accounts due, $6050, and unliquidated claims, $9936. Among the largest creditors are: A. W. Rosen & Co., $6625; Peerless Light Company, $6520; Stackpole Carbon Company. $2933.

HARRY ROTHSTEIN, purchasing agent and general manager of the electrical supply department of the Eclipse Light Company left on July 29 for Paris Island, S. C., to become a member of the Marine Corps. Miss F. Levy will succeed Mr. Rothstein during his absence.

R. H. CORSON, representative of the National Carbon Company of San Francisco, will establish offices at 314 Empire State Building, Spokane, which will become the distributing center for the Inland Empire, Northern Idaho & Western Montana.

E. B. LATHAM & COMPANY, New York City, manufacturers of electrical supplies, have filed notice of an increase in their capital from $100,000 to $200,000, to provide for business extensions.

THE AMERICAN GENERAL ELECTRIC EDISON Corporation of China, Schenectady, N. Y., has filed notice of an increase in its capital from $500,000 to $1,000,000, to provide for business extension.

F. A. MANSFIELD, formerly connected with the sales department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has resigned to take the position of Pittsburgh district sales manager of the Mechanical Appliance Company at Milwaukee, Wis. This company manufactures a complete line of alternating-current and direct-current motors, small generators, motor-generator sets and inverted rotaries.

L. D. CALHOUN has been appointed as assistant sales manager of the Square D Company, manufacturer of electrical safety switches at Detroit, Mich. Mr. Calhoun has been advertising manager of the company for the past year, and in addition to his new duties will continue to handle the company's advertising etc.

THE EDISON STORAGE BATTERY SUPPLY COMPANY of New Orleans, has moved from 201 Baronne Street to larger and more commodious quarters in the Maison Blanche Building, room 911. This move is indicative of the increasing demand for Edison storage batteries throughout the South. D. B. Mugan is district sales manager.

THE "IRON TRADE REVIEW" of Cleveland, Ohio, has published in pamphlet form a "Complete List of Base Prices, Differentials and Extras on Iron, Steel and Non-Ferrous Products," which have been fixed under Government supervision. It is claimed that this is the only up-to-date price manual on iron and steel, as the minimum changes during the past six months have rendered practically obsolete those previously issued.

THE ORENSTEIN-ARTHUR KOPPEL COMPANY of Koppel, Pa., an enemy-owned property, will be disposed of at public sale at Koppel, on Aug. 15, at 3 p. m., by A. Mitchell Palmer, alien property custodian. The company, among its other activities, manufactures electric industrial trucks.

THE MASSILLON ENGINEERING & ELECTRIC COMPANY, 416 West Main Street, Massillon, Ohio, has been recently organized and chartered and has taken over the J. C. Lewis Electric Company of that city. Mr. Lewis will be connected with the new firm as president and general manager, while the inside business management will be under Roy M. Bayless, secretary and treasurer of the company and recently superintendent of the Reliance Manufacturing Company. The present directors are Floyd C. Snyder, of the Reynolds Machine Company, Edison W. Hart of the Reliance Manufacturing Co., C. C. Miller, Joseph C. Lewis and Roy M. Bayless. While the Lewis Electric Company has enjoyed a steady growth, the new organization will provide adequately for this growing concern, which has been somewhat handicapped for lack of working capital, while the excellent directorship assures the new company's successful development. In addition to general contracting and repair work, the company will have a completely equipped storage-battery plant and magneto and ignition testing equipment and will operate a wholesale, as well as a retail department. It will also act as jobber for manufacturers' lines.

Trade Publications

ELECTRICAL CONNECTORS. — "Safest Solderless Electrical Connectors" is the title of a circular that is being distributed by the Cruban Machine & Steel Corporation, 2 Rector Street, New York. This circular describes and illustrates the several kinds of connectors that are manufactured by this company.

ELECTRICAL APPLIANCES.—The Hotpoint Division of the Edison Electric Appliance Company, Inc. of Ontario, Cal., is distributing a one-page leaflet, describing and illustrating the Hotpoint Electrical Appliances.

BALL BEARINGS.—Carwen ball bearing are described in a circular that is being distributed by the Carlston-Wenstrom Company, Richmond Street and Erie Avenue, Philadelphia, Pa. The specifications and list price of these ball-bearings for the 200 series is given.

SIGNAL SYSTEMS.—To illustrate the use of its signal system in hospitals the Holtzer-Cabot Electric Company, 125 Amory Street, Boston, Mass., has issued a card which visualizes the operation when a patient presses the signal push button.

LIGHTING UNITS.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., has issued a circular entitled "Better Lighting for Better Results" that describes the Denzar lighting unit for lighting factories, stores, shops, halls, hotel lobbies, hospitals, churches, public buildings, office buildings, apartment houses and schools.

LIGHTING FIXTURES.—The Peerless Light Company, 483 Broadway, New York, is sending out Bulletins 578 and 583. The former describes a desk or table unit called "U-ti-lite" and the latter a pull-switch chandelier.

New Incorporations

THE CARVER & NATE COMPANY of New York, N. Y., has been incorporated by F. H. Carver, C. D. Landry and E. F. Whittier, 533 Macon Street, Brooklyn, N. Y. The company is capitalized at $10,000 and proposes to manufacture hydraulic equipment.

THE ELECTRIC PRODUCTS CORPORATION of Richmond, Va., has been chartered with a capital stock of $150,000 to manufacture electrical equipment. The incorporators are O. S. Lindeman and Harold S. Blomberg.

THE H. W. EVANS COMPANY, of New York, N. Y., has been chartered with a capital stock of $20,000 by L. S. Muller, K. R. Miner and H. W. Evans, 88 Park Place, New York City.

THE ROCHESTER HOME ELECTRIC COMPANY of Rochester, N. Y., has been incorporated with a capital stock of $25,000 by P. E. Illman, J. M. Illman of Rochester, and H. Adsit Bulk of Buffalo, N. Y. The company proposes to deal in electric lighting and power plants and accessories.

THE ELECTRIC PROCESS COMPANY of Wilmington, Del., has been incorporated by M. L. Rogers, L. A. Irwin and W. G. Singer of Wilmington, Del. The company proposes to deal in steel, iron, etc.

THE DOMESTIC ENGINEERING & SPECIALTY COMPANY of Montreal, Que., Can., has been incorporated by Louis A. David, Louis P. Crepeau, S. H. R. Bush and others. The company is capitalized at $20,000 and proposes to construct, design and operate electric plants, water plants, etc., and to manufacture machinery and tools.

THE VIKING CORPORATION OF CANADA of Toronto, Ont., Can., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, automobile accessories, machinery, tools, etc. The incorporators are Thomas H. Wilson, 506 Temple Building; Jacob B. Broudy, William R. Bird and others.

THE OLDSMAR (FLA.) ELECTRIC & ICE COMPANY has been incorporated with a capital stock of $10,000 to generate and distribute electricity and also to manufacture and sell ice, etc. The officers are: Jacob Berstein, president and treasurer; Herman Bornstein, vice president, and A. Bornstein, secretary.

New England States

STRATTON, ME.—The Stratton Light Company has petitioned the Public Utilities Commission for permission to issue $10,000 in capital stock, the proceeds to be used to purchase the property of the Stratton Electric Light Company and to erect an electric transmission line from Eustis to Stratton and to purchase a generator and other equipment necessary for the power plant.

FAIRHAVEN, VT.—The Hinchey Slate Company of Fairhaven has submitted a proposition to Captain Carroll H. Shaw of Washington, D. C., and Arthur H. Fast, government attorney, appointed to act for the United States in the power situation for New England, whereby the entire output of the water power from Lake Bomoseen will be given to the Western Light & Power Company a subsidiary of the Rutland Railway, Light & Power Company, durthe period of the war. The power will be utilized to operate munition plants in the Connecticut Valley and in Massachusetts.

MONTPELIER, VT.—Preliminary papers, it is reported, have been signed by which the United States government is to take over the water-power privileges and rights of the Central Power Company on the Middlebury River at East Middlebury. The company owns 70 acres of land on the river with a head of 508 ft. It is estimated that 1400 hp. the year round can be developed. Charles H. Thompson of Montpelier is interested in the company.

BOSTON, MASS.—Contract has been awarded by the United States government to Edwin C. Lewis Inc., for the entire electrical installation at the Boston Quartermaster's Terminal at South Boston. The contract amounts to between $1,000,000 and $1,500,000.

FALL RIVER, MASS.—The Fall River Electric Light Company is now engaged in the work for the 16-mile extension of electric lighting facilities toward Providence, the extremity being at the boundary line between East Providence and Seekonk. R. F. Whitney, general manager of the company, has general supervision over the work. The cost of this line will be about $300,000 and its capacity will be 40,000 hp.

HOUSATONIC, MASS.—The new power plant of the Monument Mills at Housatonic is now in operation. The building is 221 ft. long by 96 ft. wide.

BRIDGEPORT, CONN.—The city is having plans prepared for the construction of a new pumping station to be located on Bostwick Avenue. It is planned to use the structure in connection with the proposed new sewerage treatment plant to cost $300,000. Contract for the structure has been awarded to the Eastern Engineering & Construction Company, Derby.

NORWICH, CONN.—The motive power of the plant of the Norwich Compressed Air Power Company is being changed to electricity.

NORWICH, CONN.—The Eastern Connecticut Power Company has purchased Kitemaug from William B. Walker, president of the American Thermos Bottle Company. The property consists of 75 acres and will be used in connection with the company's service line from the power plant in Montville.

WATERBURY, CONN.—Bids, it is reported, will soon be asked by the American Brass Company, Grand and Meadow Streets, for the erection of a two-story building, 90 ft. by 150 ft., and addition to power plant at Benedict and Buraw Street, to cost about $90,000.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been prepared by the American Purchase Sales Corporation, 528 Ellicott Square, for the construction of a new boiler house and pumping plant, about 20 ft. by 30 ft. and 25 ft. by 25 ft., respectively. The structures will be one story. Martin C. Miller, Mutual Life Building, is architect.

ELMIRA, N. Y.—Plans have been filed by the Willys-Morrow Company for the construction of a new 1-story addition to its power plant, about 25 ft. by 110 ft. Contract for the structure, which is estimated to cost about $30,000, has been awarded to the Lowman Construction Company, Elmira.

NEWARK, N. Y.—In connection with the proposed alterations and improvements to be made in the heating plant at the State Custodial Asylum, the Board of Managers has awarded a contract to W. F. Devendorf & Company, 470 Court Street, Rochester. The work is estimated to cost $31,000.

NEW YORK, N. Y.—Plans have been prepared by the New York Mutual Gas Light Company, 142 East Fifteenth Street, for improvements and alterations in the purifier works on Avenue D, between Twelfth and Thirteenth Streets, to cost about $20,000.

OSSINING, N. Y.—Bids will be received by the Commission on New Prisons, Room 618, Hall of Records, New York City, until Aug. 29 for electrical work, including underground electric conduit and feeder system and pump house, for Detention Building No. 5 and Clinic Building No. 8, at Sing Sing Prison, Ossining. Drawings and specifications may be consulted at the above office, at the office of the warden of Sing Sing Prison, Ossining, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher, Albany, is state architect.

SCHENECTADY, N. Y.—Ground has been broken by the Mohawk Gas Company, 511 State Street, South, for the erection of a new one story addition, about 35 ft. by 65 ft., to its works on Villa Road. The structure is estimated to cost $10,000. W. F. Devendorf & Company, 470 Court Street, Rochester, are the contractors.

SOLVAY, N. Y.—Plans are under consideration by Pass & Seymour, manufacturer of electrical specialties, for the construction of a new addition to their local plant. The structure will be three stories, about 20 ft. by 30 ft. Russell & King, Snow Building, Syracuse, are the architects.

SYRACUSE, N. Y.—The Soment-Solvay Company of Syracuse is receiving bids for construction of one-story and two-story 40 ft. by 80 ft., and 60 ft. by 120 ft. T. N. T. plants at Split Rock. H. H. Cole, is engineer.

TAYLOR, N. Y.—The mill and water rights owned by George M. Law have been purchased by R. L. Brown. Improvements will be made by the new owner, including the installation of additional electric equipment. The plant will supply electricity in Taylor and Cincinnatus.

TOTTENVILLE, S. I., N. Y.—The Public Service Commission has granted approval to the application of the New York & Richmond Gas Company for permission to issue bonds totaling $2,000,000, the proceeds to be used, in part, for improvements and extensions in its plant and system.

WESTFIELD, N. Y.—The Borough Council is planning to commence work at an early date on the erection of a new brick and concrete pumping station, to cost about $35,000. Plans for the structure have been prepared.

BOONTON, N. J.—Fire completely destroyed the boiler plant and a portion of the works of the Montville Finishing Company. The total loss is estimated at about $70,000.

CALDWELL, N. J.—Rapid progress is being made on the construction of a new telephone line from Caldwell to the Big Piece Meadows government rifle range site. About 100 new poles will be installed and the necessary lines erected.

KEARNY, N. J.—The Federal Shipbuilding Company will utilize the property recently acquired on the Hackensack River, near its present works, for the construction of a new dry dock, erection of buildings and auxiliary works. The cost of the proposed extension is estimated at more than $8,000,000.

PATERSON, N. J.—Notice has been filed by the Samuel Smith & Son Company, 150 Railroad Avenue, of an increase in its capital from $100,000 to $200,000, to provide for business extensions. The company manufactures boilers and kindred products.

ROCKAWAY, N. J.—The Empire Steel & Iron Company is contemplating improvements to its power plant to provide for continuous service. Owing to a breakdown the electric turbine has been out of commission.

VENTNOR, N. J.—The City Council has appropriated $10,000 for lighting purposes during the coming year.

HAZLEWOOD, PA.—Plans have been filed by the Jones & Laughlin Steel Company of Pittsburgh for additions to its plant at Hazlewood, to cost about $389,000. The buildings will include a machine shop, to cost $29,999; a boiler plant, $163,000; benzol works, $42,000; pump and still building, $20,000; laboratory, $13,000; naphthaline works and other buildings.

HOLLIDAYBURG, PA.—The McLanahan-Stone Machine Company is contemplating the erection of a machine shop, 40 ft. by 100 ft., with 20 ft. leanto to cost about $20,000. The center span will be equipped with an electric traveling crane.

PHILADELPHIA, PA.—Contract has been awarded by the Bellevue Worsted Mills, Wister Street, to H. E. Baton, 1813 Sansom Street, for the construction of a new power plant, 30 ft. by 90 ft., at Sixteenth and Hunting Park Avenue, to cost about $18,000.

UPPER DARBY, PA.—The Philadelphia & Western Railway Company expects to place contracts in the near future for the construction of two substations and will purchase seven 750-kw. rotaries complete.

BALTIMORE, MD.—Plans are being prepared by the Armour Packing Company, 304 South Eutaw Street, for the erection of a packing plant on Pratt and Eutaw Streets, to cost about $250,000. C. A. Stoutenberg, care of Armour & Company, 120 Broadway, New York, N. Y., is engineer.

CHARLESTON, W. VA.—Work has begun on excavation for the foundation of a new power house for the Charleston-Dunbar Traction Company, to replace the one destroyed by fire last December.

WHEELING, W. VA.—The Wheeling Traction Company will soon ask for bids for the construction of a new carhouse at Wheeling island, to replace the one destroyed by fire last February. Bids will also be asked at the same time for the construction of a 1-story shop, about 125 ft. square, to be erected at the Wheeling Island station.

BRISTOL, VA.—The installation of a new electric power plant, mining machinery and equipment, to cost more than $100,000, is under consideration by the Floyd Elkhorn Consolidated Collieries of Bristol, recently organized to take over and operate the Floyd-Elkhorn Coal Corporation and other companies.

North Central States

GRAND RAPIDS, MICH.—The Semet-Solvay Company, Milton Avenue, is contemplating the construction of a picric acid plant, to cost about $2,000,000. Bids, it is understood will soon be asked for the work. H. N. Cole is owner and engineer.

ARCANUM, OHIO.—Improvements are contemplated to the municipal electric lighting system, to cost about $3,000.

OXFORD, OHIO.—Sealed proposals will be received by the board of trustees of Miami University, Oxford, Ohio, until 12 o'clock, Aug. 22, for the furnishing and delivering f.o.b. Oxford, Ohio, of an engine and generator for the central heating and lighting plant of Miami University, Oxford, Ohio, according to the plans, descriptions, bills and estimates and specifications prepared by Walter G. Franz, consulting engineer, Cincinnati, and which are on file at his office and at the office of the president of Miami University. Proposals are to be addressed to Dr. R. M. Hughes, president of Miami University, Oxford, Ohio.

LOUISA, KY.—The Louisa, Fort Gay & Torchlight Coal & Development Company, recently incorporated with a capital stock of $1,000,000, is planning to develop coal mines opening ten collieries and building a central power plant at the mouth of Lick Creek, and constructing 10 miles of railway. C. E. Stafford is president.

GARY, IND.—Twenty-four mills will be added to the local plant of the American Tinplate Company, at a cost of approximately $10,000,000.

LOGANSPORT, IND.—Plans are being prepared by the Pennsylvania Railroad Company for extensions to its local works, to cost about $150,000, which will include addition to power plant, remodeling engine house, etc.

MONTEREY, IND.—The Monterey Electric Light & Power Company is contemplating the construction of a new power plant, 50 ft. by 125 ft., 1-story, to cost about $25,000.

CHICAGO, ILL.—Permits have been issued to the United States government for the erection of buildings to be occupied by the Symington-Chicago Corporation, 122 South Michigan Avenue. The total cost of the proposed plant is estimated at about $5,000,000, and it will be located on a tract between Ashland, Robey, Seventy-fourth and Seventy-fifth Streets. The Thompson-Starrett Company, 49 Wall Street, New York, N. Y., has been awarded general contract. The L. K. Comstock Company, 30 North Michigan Avenue, and the Freeman Sweet Company, 608 Dearborn Street, Chicago, have been awarded contracts for electric wiring. The contract for heating was awarded to Mehring & Hauson Company, 118 North Franklin Street. The plant will be devoted to the manufacture of shells.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CHICAGO, ILL.—Bids will be received by the Board of Local Improvements, Chicago, Ill., until Aug. 6 for electric-lighting equipment for upper and lower levels of North Michigan Avenue, from Randolph Street to Chicago Avenue, a distance of about 1 mile, except lower deck of proposed bridge. The cost is estimated at about $70,000. C. D. Hill is city engineer. may be seen at the office of J. E. Stanton, Associated Forum Building, Sacramento.

OTTAWA, ILL.—The Illinois Coöperative Packing Company is planning to build a power plant in connection with its new packing works, now under construction. The cost of the entire works is estimated at about $125,000.

MILWAUKEE, WIS.—The Board of Supervisors is considering the proposal of lighting the Grand Avenue viaduct and the Blue Mound Road to the county infirmary by special lines built from the electric plant of the county at the almshouse.

MILWAUKEE, WIS.—The City Illumination Bureau has started work on the installation of 1000 lamp posts, to form part of the municipal street-lighting distribution system. The posts are to be erected in sections where the present lighting service is inadequate or considered too expensive. The cost of the work is estimated at about $90,000.

MILWAUKEE, WIS.—Swift & Company of Chicago, Ill., are planning to build an addition to the power plant, 35 ft. by 70 ft., of the Plankinton Packing Company, Muskego Avenue and Canal Street, Milwaukee (leased by the company). The proposed improvements include a 100-ft. stack. Machinery for the plant, including boilers, automatic stokers, etc., it is understood, has been purchased. Harry S. Culver is general manager.

MILWAUKEE, WIS.—The Universal Machinery Company, 754 Thirtieth Street, is reported to be asking for bids through Siebert & Gray, architects, 86 Michigan Street, for the construction and equipment of a power plant, 60 ft. by 75 ft., to furnish power for its new foundry and machine shop, now in course of construction at Sixty-fourth and Pullen Avenues. The equipment will include generators, transformers, switchboards, etc. E. C. Devlin is president.

VIRGINIA, MINN.—Bonds have been authorized for improvements to the municipal electric light plant and water-works system.

EARLY, IOWA.—The local electric light plant was recently damaged by fire.

LE MARS, IOWA.—Plans are under consideration by local business men to secure better electrical service and lower rates. It is proposed to erect an electric transmission line to connect with the power plant of the Iowa Light, Heat & Power Company, just outside of the city limits. Electricity is now supplied by the Le Mars Water & Electric Light Company, which has a franchise which will not expire for several years.

HARRISONVILLE, MO.—The Board of Aldermen is considering calling an election to submit the proposal to sell or lease the municipal electric light plant to L. K. Green & Sons of Pleasant Hill.

KANSAS CITY, MO.—Bids will be received by J. Ray Samuels, purchasing agent, Kansas City, until Aug. 21 for furnishing and erecting a steam turbine reduction gear, centrifugal pumping unit having a capacity to pump continuously 20,000,000, U. S. gal. of water per 24 hours against a total combined head of 370 ft. with steam pressure of 165 pounds per square inch at throttle; together with all machinery, tools, etc. W. G. Goodwin is chief engineer and superintendent.

RICH HILL, MO.—The contract for new machinery for the municipal electric light plant has been awarded to the Merkle Machinery Company, Interstate Building, Kansas City, at $11,600.

SAVANNAH, MO.—The Savannah Light & Milling Company is planning to equip a new plant and will require new machinery, costing about $3,500.

MADISON, S. D—The power plant at Madison was completely destroyed by fire on July 27. The power plant housed all the machinery used for the electric lighting, power and water pumps.

NORFOLK, NEB.—Alex Beck, Keeline Building, Omaha, has been awarded general contract for the construction of power house, to cost about $40,000, and ward building, to cost $70,000, at the State Insane Asylum, Norfolk. W. W. Berger of Whiting, Iowa, was awarded contract for electric wiring of both buildings.

PALMER, NEB.—Plans are being prepared by the Henningson Engineering Company, Twelfth and Farnam Streets, Omaha, for construction of electric light plant and water-works system, for which $40,000 in bonds have recently been voted. Bids, for the work, it is hnderstood, will soon be asked for.

Southern States

WILMINGTON, N. C.—The Tidewater Power Company, it is reported, has made financial arrangements for the construction of an extension to the new shipbuilding plant.

JACKSONVILLE, FLA.—The Jacksonville Traction Company is contemplating an extension into the heart of Camp Joseph E. Johnston.

MIAMI, FLA.—Bonds to the amount of $30,000 have been voted for the purpose of building sidings on the municipal railway connecting with the Florida East Coast Railway. C. Murray is city engineer.

MOBILE, ALA.—The Mobile Shipbuilding Company contemplates the construction of a new shipyard for the construction of steel ships for which cranes and machinery will be required. The New York office of the company is at 30 Church Street.

GULFPORT, MISS.—Contract has been awarded to the Cooper & Greer Company, Gulfport, by the United States government, Navy Department, for the installation of a new fire protection system at the local station.

MERIDIAN, MISS.—The City Council is considering calling an election to submit to the voters the proposal to issue from $100,000 to $150,000 in bonds to establish an ice plant.

ASHDOWN, ARK.—The Commonwealth Public Service Company is contemplating the installation of an engine and generator in the electric light plant.

MARIANNA, ARK.—The City Council has instructed the light committee to obtain prices on boilers and other equipment necessary for a power plant to operate the city water pumping station. The service is now furnished by the Arkansas Light & Power Company.

LAKE CHARLES, LA.—The Louisiana Western Railroad Company is planning to construct a roundhouse and terminal facilities in Lake Charles, to cost about $132,000.

DUNCAN, OKLA.—An election will soon be held to submit to the voters the proposal to issue bonds for extensions to water-works, addition to power plant and sewage disposal plant. The Benham Engineering Company, 1300 Colcord Building, Oklahoma City, is engineer.

PONCA CITY, OKLA.—At an election held recently the proposal to issue $40,000 in bonds for improvements to electric lighting system and $35,000 for extension to water-works was carried.

POTEAU, OKLA.—At an election held recently the citizens voted to grant the Citizens' Consolidated Power & Electric Company a franchise to supply electricity in Poteau for a period of 21 years.

JUAREZ, TEX.—According to a statement made by Mayor F. D. Gonzales of Juarez, tentative plans are being made by business men of that city for an electric light plant in Juarez. According to the plans it will be theintention to erect a large power plant and bring machinery from an abandoned plant near Parral.

MILES, TEX.—Plans are being considered by W. D. Allen to construct a dam across to Concho River and also a large pumping plant. The proposed dam will store water for irrigation purposes.

ORANGE, TEX.—Plans are under consideration by the Chamber of Commerce for extensions to the lighting system.

RANGER, TEX.—The Chamber of Commerce is promoting the organization of a local company to construct an electric light and power plant.

SOMERVILLE, TEX.—A new power house will be erected by the Gulf, Colorado & Santa Fe Railway Company at its local works. Plans for the structure have been prepared.

Pacific and Mountain States

SEATTLE, WASH.—The Capital Issues Committee has under consideration the application of the city of Seattle to sell $5,500,000 in bonds for the construction of hydroelectric plants on the Skagit River. The municipality is seeking to sell $1,500,000 in bonds this calendar year and $1,000,000 every six months thereafter until the entire amount is floated.

CASTELLA, CAL.—The California-Oregon Power Company of San Francisco has started work on the erection of a high-tension transmission line from Castella to Kennett, where connection will be made with the transmission system of the Northern California Power Company. The proposed line will be 35 miles long and will furnish electricity to the Mammoth mine and smelter at Kennett, relieving the Northern California Power Company of its load so that it can deliver more power at Chico and Hamilton City to the Pacific Gas & Electric Company. This line will interlock the three power systems.

REDLANDS, CAL.—The Coachella Valley Ice & Electric Company, Redlands, Cal., has been purchased by the Southern Sierras Power Company, Denver, Col. Through this purchase the Southern Sierras Power Company becomes the owner of the entire electric system of the Coachella company in Riverside and Imperial counties.

SAN DIEGO, CAL.—Plans are being considered by the San Diego Consolidated Gas & Electric Company for enlarging its plant and extensions to its power system. The company was recently given authority to issue $1,100,000 in bonds.

SAN DIEGO, CAL.—Contract has been awarded by the United States government to Lange & Bergstrom, Sharon Building, San Francisco, for the construction of new aircraft works on North Island, San Diego, to cost about $400,000. The proposed plant will consist of a machine shop, carpenter shop and other buildings.

SAN FRANCISCO, CAL.—The Northern California Power Company has begun work on a high-voltage transmission line from Hamilton City to Colton.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, it is reported, will erect a substation at Knights Landing, Yolo County, to connect up a transmission line at Colusa, at which point connection will be made with the Northern California Power Company as part of the power-pooling plan. The plant will cost about $250,000 and will have a capacity of about 8000 kw.

OGDEN, UTAH.—The Globe Grain & Milling Company, Santa Fé Avenue, Los Angeles, Cal., is contemplating the construction of a mill and warehouse in Ogden, to cost about $500,000.

PUEBLO, COL.—Two new alfalfa mills are being erected in the Arkansas Valley district, between Ordway and Crowley. Both mills will be equipped for electrical operation. Electricity will be furnished by the Arkansas Valley Railway, Light & Power Company. The transmission line to serve these mills will also supply energy to several ranches on the line.

SANTA FE, N. M.—The Santa Fé Water & Light Company is contemplating extensions to its water-works system, to cost about $200,000.

Canada

VANCOUVER, B. C.—The Dominion Canners, Ltd., is contemplating the construction of a new boiler house at Vancouver, to cost about $60,000. A. E. Henderson is architect.

NEWCASTLE, N. B.—The Light and Water Commission is considering extensions and improvements to the municipal electric-light plant, to cost about $125,000. J. E. T. London is city clerk.

FORT WILLIAM, ONT.—The Department of Finance has been granted permission to issue $225,000 to be used for street-railway purposes.

BAGOTVILLE, QUE.—Preparations are being made by the Ponliot Company for the construction of a sawmill and rossing plant, to cost about $30,000. The company is in the market for equipment, including steam engine, boilers, etc.

COATICOOK, QUE.—The Council is considering extensions to the municipal electric-light plant, to cost about $7,500.

MONTREAL, QUE.—The construction of a power house, to cost about $10,000, is under consideration by Lamontagne, Ltd., 338 Notre Dame Street West.

MEOTA, SASK.—The installation of a municipal electric-light plant, to cost about $40,000, is under consideration by the town of Meota. A. E. Thompson is secretary and treasurer.

1,271,246. STERILIZING LIQUID; Max von Recklinghausen, André Helbronner and Victor Henri, Paris, France. App. filed Dec. 21, 1912. Relates to vapor-electric apparatus which is adapted for the production of ultra-violet rays for the sterilization of liquids.

1,271,255. ELECTROMAGNETIC CIRCUIT CONTROLLER; Alfred A. Zeigler, Boston Mass. App. filed May 26, 1916. Automatic operation by an electromagnet.

1,271,263. ELECTROMAGNET; Charles F. Baldwin, Montclair, N. J. App. filed Sept. 3, 1915. To provide an inexpensive and efficient slow-acting electromagnet.

1,271,267. ELECTROTHERMIC EXTRACTION OF ZINC; Edward S. Berglund, Trollhättan, Sweden. App. filed July 25, 1917. Consists in conducting zinc-containing vapors simultaneously from two or more smelting furnaces to a common condenser.

1,271,316. ELECTRIC SWITCH; Charles H. Hill, Schenectady, N. Y. App. filed May 23, 1914. For use upon theatrical or other switchboards of similar character.

1,271,320. ELECTRIC CONDUCTOR; William G. Houskeeper, Philadelphia, Pa. App. filed Sept. 11, 1916. Relates to the formation of seals between the walls of vitreous vessels and to conductors efficacious in making such seals.

1,271,322. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed April 24, 1917. A link circuit for automatically connecting an operator's telephone set upon connection of the link circuit with a calling line.

1,271,335. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Jan. 11, 1916. "Busy" indication will be effective only with the receiver of an operator's telephone set.

1,271,336. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Nov. 14, 1916. For the purpose of visually indicating the number of a telephone line to an operator.

1,271,337. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Dec. 30, 1916. For preventing the connection of a line-finding switch with two lines simultaneously.

1,271,374. ELECTRODYNAMIC MACHINERY; Amato N. Sammarone, Akron, Ohio. App. filed Jan. 25, 1916. Generators or motors constructed largely of rolled or die-pressed sheet metal.

1,271,378. NON-INTERFERING KEY; Charles H. Smith, Chicago, Ill. App. filed June 19, 1913. Providing automatic means to prevent more than one switch-actuating member being effectively actuated at one time.

1,271,390. BUTTONHOLE ELECTRIC LIGHT; Edwin F. Thomas, Meriden, Conn. App. filed July 31, 1917. Quickly fastened to the garment so that the light rays radiating therefrom may penetrate in the pathway.

1,271,401. MAGNETIC CLUTCH; Jarl M. Weydell, Indianapolis, Ind. App. filed Feb. 15, 1917. For connecting two moving parts without any sliding contacts.

1,271,407. PROTECTIVE DEVICE; George Wolff, near Berlin, Germany. App. filed Jan. 11, 1915. Device is inclosed in tank to simplify and cheapen the application.

1,271,409. COIL-RETAINING DEVICE; Francis E. Wynne, Wilkinsburg, Pa. App. filed July 3, 1916. Applied to the magnetizable core member of a dynamo-electric machine to retain the coils securely in the slots of such member.

1,271,428. PROCESS OF ELECTRICAL WELDING AND APPARATUS USED IN CONNECTION THEREWITH; John Burns, Kenosha, Wis. App. filed Oct. 30, 1916. Adapted to electrically welding the seam of a tube.

1,271,438. DYNAMO-ELECTRIC MACHINE; Charles S. Cook, Pittsburgh, Pa. App. filed Nov. 25, 1914. Relates to ventilating structures for railway motors.

1,271,441. MAGNETO; William W. Dean, Stamford, Conn. App. filed Aug. 22, 1916. The rotor is in the form of a permanent magnet having a plurality of poles.

1,271,469. FIRE-ALARM BOX; Szczepan Horst and Waclaw Horst, Buffalo, N. Y. App. filed May 28, 1917. The person sending in the alarm is retained with his arm in the box until the proper officer reaches the box.

1,271,475. REGULATOR FOR MOTOR ARC LAMP; Johann Kiefer, Charlottenburg, Germany. App. filed July 20, 1915. A direct-current motor is geared to the electrodes whereby the latter are actuated to recede from or approach each other.

Record of Electrical Patents

Notes on United States Patents

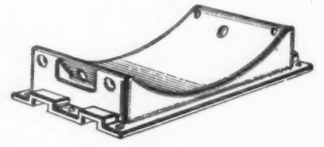
1,271,478. FLOOR BOX; Hubert F. Krantz, Brooklyn, N. Y. App. filed Dec. 18, 1912. To provide against short-circuiting by water or any other foreign element.

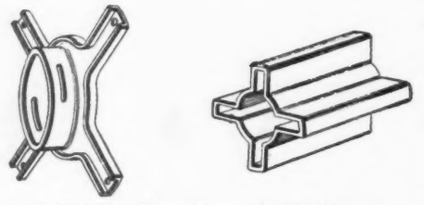
1,271,483. INCANDESCENT LAMP; Irving Langmuir, Schnectady, N. Y., App. filed Sept. 4, 1913. The helical winding of the filament is interrupted at certain points to leave portions of the filament substantially uncoiled.

1,271,514. SOUNDER; Thomas J. Murphy, Rochester, N. Y. App. filed Oct. 2, 1916. May be telegraphically operated by an alternating current.

1,271,520. QUICK-BREAK SWITCH; Alexander K. Sutherland, New Britain, Conn. App. filed Nov. 5, 1917. Can be easily assembled and will be quick and positive in its action.

1,271,524. SELECTIVE MOTOR; James Burke, Erie, Pa. App. filed June 28, 1911. The starting and operating of motors are selective as regards the frequency of the single-phase supply.





1,271,374—Electrodynamic Machinery

1,271,535. ELECTRIC CIRCUIT CHANGING APPARATUS; Joseph Bijur, New York, N. Y. App. filed Aug. 26, 1911. To provide a practical and reliable device for intermittently interrupting an electric curcuit.

1,271,555. SWITCH MECHANISM; Elie F. G. H. Faure, Erie, Pa. App. filed March 17, 1914. Has reference to means for causing a reciprocatory bar to move quickly in one or both directions.

1,271,577. ELECTRIC CLOTHES PRESSER; Joseph Jeannetaud, Dubuque, Iowa. App. filed Aug. 6, 1915. For use by tailors and those engaged in repairing clothes.

1,271,592. RAILWAY SIGNALING; Ronald A. McCann, New Brunswick, N. J.; App. filed Aug. 19, 1914. Applies to signaling for stretches of single track between passing sidings.

1,271,593. RAILWAY SIGNALING; Ronald A. McCann, Swissvale, Pa. App. filed Aug. 19, 1914. Signaling for single track over which traffic moves in both directions.

1,271,596. INSULATOR SUPPORT; Walter S. Mayer, Philadelphia, Pa. App. filed April 21, 1917. Characterized by method for clamping it firmly to carrying means.

1,271,600. ELECTRIC SIGN; Albert C. Meyer, San Diego, Cal. App. filed May 3, 1917. To facilitate the making of a large number of changes in the sign with comparatively small flashing apparatus.

1,271,624. AUTOMOBILE THIEF ALARM; Joseph I. Silbar, St. Paul, Minn. App. filed Apr. 7, 1917. Will automatically ring a bell when a thief attempts to start or even to enter an automobile.

1,271,633. METHOD OF ELECTROLYTIC PRODUCTION OF PERCHLORIC ACID; Edward C. Walker, Brookline, Mass. App. filed April 23, 1917. Produced with economy consistent with commercial requirements.

1,271,682. ELECTRIC LOCOMOTIVE; George M. Eaton, Pittsburgh, Pa. App. filed Jan. 4, 1916. Trucks are disposed relative to one another to insure good tracking and running qualities in the locomotive.

1,271,690. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Jan. 29, 1915. Especially adapted for use on board boats or ships.

1,271,691. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Dec. 3, 1917. To provide means accessible from the outside of the cover for fastening a filling and ventilating standpipe to the cover.

1,271,692. ELECTRIC STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed March 29, 1918. To provide for safely hoisting complete or assembled cells.

1,271,696. AUTOMOBILE SIGNAL; Manious Garl, Akron, Ohio. App. filed March 27, 1917. Chauffeur gives a signal at the time he is about to turn or stop the automobile.

1,271,713. METHOD FOR THE PRODUCTION OF SILICON TETRACHLORIDE; Otis Hutchins, Niagara Falls, N. Y. App. filed Oct. 30, 1917. By passing dry chlorine over silicon carbide heated to a temperature of 1000 deg. C.

1,271,732. CURRENT MODIFIER; Oscar M. Leich, Genoa, Ill. App. filed March 24, 1915. Application in connection with vibrators used for signaling purposes in telephone exchanges.

1,271,733. CURRENT MODIFIER; Oscar M. Leich, Genoa, Ill. App. filed March 24, 1915. Can be operated directly from an alternating-current circuit and provide intermittent or pulsatory current of a frequency other than that of the source.

1,271,735. ILLUMINATED WATCH HOLDER; Benjamin F. Lockwood, Oakland, Cal. App. filed Sept. 5, 1916. To produce a simple and effective holder for the watch or other timepiece to be carried in the glove.

1,271,760. ELECTRIC FURNACE; Carl A. Pfanstiehl, Highland Park, Ill. App. filed Oct. 30, 1916. Useful for the reduction of tungsten trioxide WO_3 to metallic tungsten powder.

1,271,788. VARIABLE POWER REGULATION; John A. Snee, Jr., West Elizabeth, Pa. App. filed Feb. 16, 1915. Automatic regulation of prime movers in such manner as to maintain the wheel under the most efficient load.

1,271,793. BRUSH HOLDER; Robert W. Stanley, Cleveland, Ohio. App. filed Dec. 11, 1916. The equalization of the pressure exerted by the two brushes of a pair.

1,271,794. PROTECTIVE DEVICE; George H. Stevenson, Mount Vernon, N. Y. App. filed Nov. 20, 1916. Relates to devices for protecting electric circuits from lightning and more particularly to protective devices of the vacuum type.

1,271,806. FIRE ALARM; Edith L. Tibbs, Greenville, S. C. App. filed June 12, 1916. Heat from fire will be a prime factor in closing an electrical circuit.

1,271,815. HEAT REGULATOR; Everett H. White, St. Paul, Minn. App. filed Jan. 10, 1916. Employs an expansible chamber filled with ether gas as the thermostatic element.

1,271,822. GAS RANGE LIGHTING APPLIANCE; Nicholas Zam, Cleveland, Ohio. App. filed July 31, 1917. An electrical system adapted to deliver a spark in ignitable proximity to a fuel burner.

1,271,824. TELEPHONE AND TELEGRAPH CABLE; Gustavus A. Anderegg and Wilbur E. Mougey, Oak Park, Ill. App. filed June 30, 1916. The production of duplex cable highly efficient in the transmission of electrical impulses over the conductors therein.

1,271,831. RAILWAY SAFETY SIGNAL; Wilhelm Swoboda, Alton, and Boleslaw Swoboda, East St. Louis, Ill. App. filed July 7, 1916. If switch ahead of train is in unsafe position, engineer on locomotive is given signal to prevent accident.

1,271,835. LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed July 8, 1915. Construction which is particularly advantageous in pull switch sockets.

1,271,842. CABLE SPLICE; Newton K. Bowman, Canton, Ohio. App. filed Oct. 4, 1915. To prevent interference of the splice with the smooth and ready winding of the cable upon the spool.

1,271,855. TRUNKING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed March 6, 1915. Particularly adapted to automatic telephone exchange.